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MINERALS YEARBOOK

Area Reports: International 2008

Africa and the Middle East

Volume III

USGS
science for a changing world

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U.S. Department of the Interior
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MINERALS YEARBOOK

Area Reports: International 2008

Africa and the Middle East

Volume III

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U.S. GEOLOGICAL SURVEY
Marcia K. McNutt, Director

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industries during 2008 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Marcia K. McNutt, Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the Internet at http://www.usgs.gov or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, Global Minerals Analysis Section, National Minerals Information Center (NMIC), at (703) 648-7732, or the NMIC secretary at (703) 648-4961. Additional minerals information may be accessed on the Internet at http://minerals.usgs.gov/minerals.

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Acknowledgments

The Country Specialists in the National Minerals Information Center, U.S. Geological Survey, in preparing the International Review regional books of volume III of the Minerals Yearbook, extensively use statistics and data on mineral production, consumption, and trade provided by various foreign Government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations are gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, United Nations publications, and the domestic and foreign technical and trade press. Of particular assistance were reports submitted by the Resource Reporting Officers and other officers of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section of the National Minerals Information Center.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Director, National Minerals Information Center

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The Mineral Industries of Africa

By Thomas R. Yager, Omayra Bermúdez-Lugo, Philip M. Mobbs, Harold R. Newman, Mowafa Taib, Glenn J. Wallace, and David R. Wilburn

The 56 independent nations and other territories of continental Africa and adjacent islands covered in this volume encompass a land area of 30.1 million square kilometers, which is more than three times the size of the United States, and were home to 984 million people in 2008. For many of these countries, mineral exploration and production constitute significant parts of their economies and remain keys to future economic growth. Africa is richly endowed with mineral reserves and ranks first or second in quantity of world reserves of bauxite, chromite, cobalt, hafnium, industrial diamond, manganese, phosphate rock, platinum-group metals (PGM), soda ash, vermiculite, and zirconium.

The mineral industry was an important source of export earnings for many African nations in 2008. To promote exports, groups of African countries have formed numerous trade blocs, which included the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC), the Economic Community of Central African States, the Economic Community of West African States, the Mano River Union, the Southern African Development Community (SADC), and the West African Economic and Monetary Union. Algeria, Angola, Libya, and Nigeria were members of the Organization of the Petroleum Exporting Countries (OPEC). In 2008, COMESA, EAC, and SADC agreed to form an expanded free-trade zone. The African Union was formally launched as a successor to the Organization of African Unity in 2002 to accelerate socioeconomic integration and promote peace, security, and stability on the continent.

The U.S. Geological Survey (USGS) acknowledges and expresses its sincere appreciation to the following Government agencies, international institutions, and private research organizations for providing mineral production statistics, basic economic data, and mineral exploration and other mineral-related information:

For mineral production statistics—
- Algeria—Ministry of Energy and Mines,
- Benin—Ministry of Mines, Energy, and Water,
- Burundi—Ministry of Energy and Mines,
- Côte d'Ivoire—National Institute of Statistics,
- Egypt—Ministry of Petroleum,
- Ethiopia—Ministry of Mines and Energy,
- Gambia—Geological Department,
- Ghana—Minerals Commission,
- Guinea—Ministry of Mines, Geology, and Environment; National Directorate of Statistics,
- Mali—National Directorate of Geology and Mines,
- Mauritania—National Office of Statistics,
- Mauritius—Central Statistics Office,
- Morocco—Directorate of Statistics,
- Mozambique—National Directorate of Mines,
- Namibia—Ministry of Mines and Energy,
- Niger—National Institute of Statistics,
- South Africa—Department of Minerals and Energy, Mineral Economics Directorate,
- Swaziland—Central Statistical Office,
- Tunisia—Industrial Promotion Agency,

For basic economic data—the International Monetary Fund.

For mineral consumption data—
- BP p.l.c.,
- Department of Minerals and Energy of the Republic of South Africa, and
- International Iron and Steel Institute.

For exploration and other mineral-related information—the Metals Economics Group (MEG) in Canada.

General Economic Conditions

In 2008, the real gross domestic product (GDP) of Africa increased by 5.2% after increasing by 6.3% in 2007. In 2008, the GDP increased by an average of 6.1% in African petroleum-exporting countries and by an average of 4.7% in African petroleum-importing countries. GDP growth in African petroleum-exporting countries was projected to be at or about 2.2% in 2009 and 5.1% in 2010. In petroleum-importing countries, GDP growth was expected to be at or about 1.4% in 2009 and 3.3% in 2010 (International Monetary Fund, 2009, p. 90).

Decreased economic growth is likely to be the result of the worldwide economic crisis that started in late 2007. In Botswana, the GDP is expected to decrease by about 10.2% in 2009 because of the collapse in global demand for diamond. South Africa's GDP is likely to decrease by 2.2% in 2009 in part because of a broadly based decrease in mineral production. Angola, Equatorial Guinea, and Nigeria were likely to face adverse economic effects from the decrease in worldwide petroleum demand (International Monetary Fund, 2009, p. 89-90, 173).

Investment Data and Political Risk

Despite the decrease in the GDP in 2009 in South Africa, numerous new mines and expansions of existing mines were planned that included coal, diamond, gold, iron ore, manganese, PGM, titanium, and zirconium mines. The estimated capital costs of the expansion of the Sishen iron ore mine was $1.2 billion; the new Sishen South iron ore mine, $1.1 billion; the Goedgevonden coal mine, $390 million; the Burnstone gold mine, $238 million; and the Xolobeni mineral sands mine, $200 million.

Elsewhere, capital expenditure for the Ambatovy nickel mine in Madagascar was expected to total $3.3 billion by 2013. The capital costs of the Moatize and the Benga coal mines in Mozambique were estimated to be $1.4 billion and

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$800 million, respectively. In the Democratic Republic of the Congo [Congo (Kinshasa)], the estimated capital cost of the Tenge Funkurume copper mine was $1.9 billion; the Ruashi Mine, $335 million; and the Kinsevere Mine, $200 million. The capital cost of the Kouilou potash mine in the Republic of the Congo [Congo (Brazzaville)] was estimated to be $723 million.

Projects in the feasibility or prefeasibility stage included the Twangiza and the Moto gold mines in Congo (Kinshasa), which had estimated capital costs of $541 million and $483 million, respectively. In Madagsacar, the capital cost of the Ranobe mineral sands project was expected to be $250 million. The capital cost of the proposed Kanyika niobium (columbium) mine in Malawi was estimated to be between $156 million and $177 million.

Countries directly affected by wars, internal ethnic or political conflicts, and refugee displacements in 2008 included Chad, Congo (Kinshasa), Côte d'Ivoire, Ethiopia, Nigeria, Somalia, Sudan, and Uganda.

Legislation

High mineral commodity prices at the beginning of 2008 led some Governments in Africa to review existing mining agreements with a view toward increasing state revenues from exploration and mining companies. Mineral exploration projects in Congo (Kinshasa) are ongoing in spite of concerns related to the Government's reevaluation of mining contracts and unrest in parts of the country (Vaccaro, 2008). Mining contracts in Guinea are also being reviewed after a change in government following the death of President Conte (Mukumbira, 2008; Mining Review Africa, 2009). In November 2007, the Government of Tanzania appointed the Mining Review Contracts Committee to review all mining contracts. In July 2008, the Committee recommended that the Government own 10% of the shares of all mining companies in Tanzania (Mining Journal, 2008).

Zimbabwe implemented its Indigenization and Economic Empowerment Act in 2008, which requires that indigenous Zimbabweans own at least 51% of any business operating in Zimbabwe. Zimbabwe's central bank has proposed reforms to the country's mining sector that would effectively make the Zimbabwe Mining Development Corp. the sole explorer for minerals; the reforms would also put in place a strict monitoring of the production, refining, and valuing of precious metals on site and ban the export of unprocessed minerals containing chrome, raw diamond, gold, and PGM (Nkala, 2009). In light of the decrease in commodity prices and economic uncertainty at the end of 2008, it was unclear how many of the proposed legislative changes would be enacted or enforced (Thomson Reuters, 2009).

Exploration

Exploration activity, as defined by African exploration budgets reported by the MEG, increased by 19% to $1.9 billion in 2008 from about $1.6 billion in 2007. The share of Africa exploration in the total worldwide exploration budget decreased slightly to about 15% in 2008. In 2008, the principal mineral commodities of interest for exploration in Africa were base metals, diamond, gold, PGM, and uranium (Metals Economics Group, 2008).

Exploration was focused primarily in (in order of the number of sites being actively explored) South Africa, Zambia, Namibia, Tanzania, Congo (Kinshasa), Ghana, Burkina Faso, and Mali, but activity also took place in a number of other countries. Gold targets accounted for approximately 33% of reported African exploration projects; PGM made up about 15%; copper and diamond each represented about 13%; uranium made up about 12%; and base metals made up about 7%. Based on the number of active exploration sites, early-stage projects composed about 53% of the 2008 activity, whereas producing projects accounted for about 24% and feasibility stage projects represented about 16%.

Exploration activity in Africa in 2008 fluctuated widely over the course of the year as the result of changing commodity prices, disruption of mineral supply owing to electricity shortages and regional unrest, and reduced credit availability. At the beginning of 2008, commodity prices were high and mineral exploration was active in many areas of the region. Australian and Canadian companies, which have traditionally invested heavily in African minerals projects, announced plans to continue such investment. China announced ambitious plans to invest in the mineral sector of such African countries as Congo (Kinshasa), Guinea, Niger, South Africa, and Zambia. Indian-owned companies expanded efforts to prospect for gold and uranium in Niger and announced development plans for manganese and iron ore projects in Côte d'Ivoire (Cocks, 2008). Russian firms were also investigating opportunities to gain additional access to African minerals (Pfeiffer, 2008). Exploration activity in South Africa was affected by electricity shortages in early 2008. Despite high levels of interest in exploration, global financial difficulties at the end of 2008 further affected mineral-dependent economies in Africa, particularly Botswana, Congo (Kinshasa), South Africa, Zambia, and Zimbabwe, leading to layoffs and scaled-back investment and growth projections (Tsiko, 2009).

Commodity Overview

Estimates for production of major mineral commodities for 2008 and beyond have been based upon supply-side assumptions, such as announced plans for increased production/new capacity construction and bankable feasibility studies. The outlook tables in this summary chapter show historic and projected production trends; therefore, no indication is made about whether the data are estimated or reported and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect current (2008) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes estimates of future production, exploration and mine development, cost of capital projects, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected outcomes. Projects listed in

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the following section are presented as an indication of industry plans and are not a USGS prediction of what will occur.

Metals

Aluminum and Bauxite and Alumina.—*Production.*—In 2008, African production of refined aluminum decreased by 5% compared with that of 2007. South Africa accounted for about 47% of African aluminum output; Mozambique, 31%; and Egypt, 15% (table 6). Africa accounted for 4% of the world's aluminum production in 2008. In Mozambique and South Africa, production decreased because of power supply constraints. The smelter at Ikot Abasi reopened in Nigeria.

African bauxite production increased by 5% in 2008. In Guinea, production increased at Compagnie des Bauxites de Guinée and Compagnie des Bauxites de Kindia's mines. Output decreased at the Sierra Mineral Mine in Sierra Leone. Guinea accounted for about 91% of African bauxite production, and Sierra Leone, 5% (table 5). In 2008, Africa's share of world bauxite production was 9%.

Consumption.—In 2008, world aluminum consumption amounted to 36.9 million metric tons (Mt) compared with 37.2 Mt in 2007. Africa accounted for about 2% of world aluminum consumption in 2008 (Chili, 2009a).

Outlook.—The production of refined aluminum is expected to increase by an average of about 3% per year from 2008 to 2015. Output is likely to increase at the Nag Hammadi smelter in Egypt by 2011. In Nigeria, the smelter at Ikot Abasi could reach full capacity by 2013. In Ghana, the reopening of the Valco smelter by 2013 would depend upon reliable power supplies (table 6).

African bauxite production is likely to remain nearly unchanged from 2008 to 2015. Ghana's production is expected to increase by about 15% by 2013 (table 5).

Copper.—*Production.*—Africa's mine production of copper increased by about 15% in 2008 compared with that of 2007. In 2008, Zambia accounted for 58% of African copper mine production; Congo (Kinshasa), 24%; and South Africa, 11% (table 7). Africa's share of world copper mine production was 6% in 2008. The production increase in Congo (Kinshasa) was attributable to increased output from the Etoile, the Frontier, the Kalumines, the Kinsevere, the KTO, the Ruashi, and the T17 Mines. The Dikilushi, the Kulu, the Luiswishi, and the Tilwezembe Mines were shut down in late 2008 because of the worldwide economic crisis, and the Lonshi Mine was shut down because of resource depletion. In South Africa, output increased at the Palabora Mine. Production also increased in Zambia.

Africa's refined copper production increased by 5% from 2007 to 2008. In 2008, Zambia accounted for 72% of African refined copper production; South Africa, 17%; and Congo (Kinshasa), 8% (table 8). In Congo (Kinshasa), the Ruashi solvent extraction-electrowinning (SX/EW) plant opened in 2008 and production increased at the Etoile, the Luilu, and the Luita SX/EW plants. Production also increased in Zambia. Decreased output in South Africa was mostly attributable to reduced output from the Palabora refinery. Egypt was the only producer of secondary refined copper in Africa; primary production accounted for most African production.

Consumption.—In 2008, world refined copper consumption decreased by about 1% to 18 Mt. Africa's share of global copper consumption amounted to about 2% in 2008. South Africa's consumption decreased to 68,000 t in 2008 from 77,000 t in 2007 (Chili, 2009b).

Outlook.—African copper mine production is expected to increase by an average of about 9% per year from 2008 to 2015. Congo (Kinshasa) is likely to account for a majority of the increase in output. The Tenke Fungurume Mine is planned to open in 2009, and the Kipoi Mine, in 2010. Increased production is also likely at the Etoile and the Ruashi Mines in 2009 and at the Kinsevere Mine in 2011. The first phase of the expansion of the Kamoto and the KOV Mines is expected to be completed in 2011, and the second phase, in 2015. The Congolese share of African copper production is likely to increase to 42% in 2015 from 24% in 2008 (table 7; Mining Journal, 2010a, b).

Nevsun Resources Ltd. plans to mine from a copper-rich zone at the Bisha Mine in Eritrea from late 2012 to 2015. South Africa's production is expected to increase because of the expansion of the Nkomati nickel mine by 2012. In Botswana, the Boseto Mine is likely to open in 2012. Tanzania's output is likely to increase with the opening of the Buzwagi gold mine in 2009 (table 7).

The production of refined copper is expected to increase by between 12% and 13% per year from 2008 to 2015. In Congo (Kinshasa), new SX/EW plants could open at Tenke Fungurume in 2009 and at Kinsevere in early 2011. Increased production is also expected from the Etoile, the Luilu, the Luita, and the Ruashi plants. The first phase of expansion at Luita is likely to be completed in 2011, and the second phase, in 2015. Congo (Kinshasa), which produced less than 1% of Africa's refined copper in 2007, could account for 52% of the continent's refined copper output by 2015 (table 8; Mining Journal, 2010a, b).

Gold.—*Production.*—Africa's gold mine production was about 439,000 kilograms (kg) in 2008, which was a decrease of about 9% compared with that of 2007. Production decreased significantly since 1995 because of the long-term decline in South African production that more than offset the increased output in Ghana, Guinea, Mali, and Tanzania (table 9). In 2008, Africa's share of world gold mine production was about 22% (table 4).

In South Africa, the decrease in production was broadly based, with output declining from each of the country's five leading gold producers. Decreases in Ghana's gold production were partially attributable to the Chirano and the Tarkwa Mines. In Tanzania, decreased production from the Bulyanhulu, the Geita, and the North Mara Mines more than offset the production increases from the Golden Pride and the Tulawaka Mines. Mali's production decreased in 2008; the decreases in output from the Loulo, the Morila, and the Yatela Mines more than offset the increased output from the Sadiola Mine. Production also decreased in Ethiopia, Kenya, Niger, Sudan, and Zimbabwe (table 9).

In Guinea, production increased at the Kiniero, the Lero, and the Siguiri Mines in 2008. Output increased in Burkina Faso because of the opening of the Kalsaka, the Mana, and the Youga Mines. Côte d'Ivoire's production increased because of the opening of the Angovia and the Bonikro Mines (table 9).

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In 2008, South Africa accounted for 49% of African gold production; Ghana, 18%; Mali, 9%; and Tanzania, 8%. South Africa's share of continental gold production decreased from 81% in 1995 because of rising production costs associated with deeper underground operations and increased production in Ghana, Guinea, Mali, and Tanzania (table 9).

Outlook.—Gold mine production in Africa is expected to increase by an average of about 4% per year from 2008 to 2015. The long-term decline in South Africa's production could be reversed because of the reopening of mines in the Central Rand gold fields and the opening of the Modder East Mines in 2009, and the opening of the Burnstone and the Weltdvreden Mines in 2010 and 2011, respectively. Other new gold projects include the Ergo Mine and the Tshepong Decline project in 2008 and the planned expansion of the Masimong Mine in 2010. The expansion of the Tau Lekoa Mine is expected to be completed in 2010; the Phakisa and the Savuka Mines, in 2011; the Doornkop, the Elandsrand, and the Moab Khotsong Mines, in 2012; and the South Deep Mine, in late 2014. The opening of uranium mines, including the Buffelsfontein and Ezulwini Mines, is also likely to contribute to increased gold production; gold is a coproduct at these mines (table 9; Simmer and Jack Mines Ltd., 2010).

In Ghana, the outlook is for an increase in output because of increased production from the Bogosu/Prestea, the Chirano, the Damang, the Obuasi, and the Wassa Mines by 2011 and the startup of the Southern Ashanti project by 2013. Tanzania's production is likely to increase with the opening of the Buzwagi Mine in 2009 and increased production at the Geita Mine; these increases could more than offset the planned closures of the Tulawaka and the Golden Pride Mines in 2011 and 2013, respectively. In Mali, the expansion of the Loulo and the Yatela Mines and the reopening of the Syama Mine by 2011 are expected to more than offset the decreased output from the Morila Mine (table 9).

Burkina Faso's production is expected to increase with the expansions of the Kalsaka, the Taparko-Boroum, and the Youga Mines by 2011. In Mauritania, output is likely to increase at the Tasiast Mine. The outlook for Côte d'Ivoire is for a substantial increase in production because of the opening of the Tongon Mine and the expansion of the Bonikro Mine. In Ethiopia, the Sakaro Mine is likely to open in 2011, and the Werseti Mine, in 2015. Production could increase in Zimbabwe, depending upon the restoration of economic and political stability (table 9).

Several African countries that had only artisanal gold production in 2008 are likely to open large-scale gold mines in the near future. In Congo (Kinshasa), the Twangiza Mine could open in late 2011; the Namoya Mine, in 2012; and the Kibali Mine, in 2014. Gold-rich zones in the Bisha Mine in Eritrea are planned to be mined from 2010 to 2012. Other new mines opening include the Sabodala Mine in Senegal in 2009, the Sukari Mine in Egypt in 2009, and the Passendro Mine in the Central African Republic in 2010 (table 9).

Other African countries are expected to lose their only large-scale gold mines in the near future. The Hassai Mine in Sudan is likely to shut down in 2012, and the Mupane Mine in Botswana, in 2013 (table 9).

Iron and Steel.—*Production.*—African production of crude steel decreased by about 3% in 2008 compared with that of 2007. In South Africa, the decrease in output was partially attributable to decreased output at the Saldanha plant. Production decreased in Algeria and Libya and increased in Mauritania and Morocco. South Africa accounted for 44% of regional crude steel production; Egypt, 32%; Libya, 6%; and Algeria, 3% (table 11). Africa's share of world crude steel production amounted to 1% in 2008 (table 4).

In 2008, Egypt's production of hot-rolled steel products was 6.77 Mt compared with 6.67 Mt in 2007. In South Africa, output decreased to 6.42 Mt in 2008 from 7.11 Mt in 2007, and in Morocco, to 0.92 Mt from 1.02 Mt. Other African producers of hot-rolled steel products included Algeria, Libya, and Tunisia (World Steel Association Committee on Economic Studies, 2010, p. 39).

Consumption.—In 2008, world finished steel consumption decreased to 1.21 billion metric tons (Gt) from 1.22 Gt in 2007. African finished steel consumption increased to nearly 26.8 Mt in 2008 from 22.9 Mt in 2007. Egypt accounted for 24% of African finished steel demand; South Africa, nearly 23%; Algeria, 19%; Morocco, 9%; Nigeria, 6%; and Libya and Tunisia, 5% each (World Steel Association Committee on Economic Studies, 2010, p. 95-96).

Outlook.—Crude steel production is expected to increase by an average of 3% per year from 2008 to 2015. Nigeria could more than double its production with the opening of the Ajaokuta plant and the reopening of the Delta plant by 2015. ArcelorMittal plans to increase output in Algeria and to open a new plant in Egypt by 2011. Production could increase in Zimbabwe from 2011 to 2015 as Zimbabwe Iron and Steel Co. restores its capacity; improvement in this company's situation depends upon the restoration of economic and political stability. Output is also expected to increase in Libya, Mauritania, and Tunisia (table 11).

Iron Ore.—*Production.*—In 2008, the iron content of ore produced in Africa amounted to 40.1 Mt. Increased production in South Africa was attributable to the Beeshoek and the Sishen Mines. Production decreased in Egypt and Mauritania. South Africa was the leading iron ore producer in Africa and accounted for 77% of continental output; Mauritania, 18%; and Algeria, 3% (table 10).

Outlook.—The iron content of ore produced in Africa is expected to increase to about 79 Mt in 2015 (table 10). In South Africa, the current expansion of the Sishen Mine is likely to be completed in 2010; a further expansion of the mine could be completed by 2013. Production at the Khumani Mine is planned to reach full capacity in 2010; a further expansion of the mine could be completed by 2013. Increased output at Khumani would more than offset the expected decrease in output from the Beeshoek Mine starting in 2009. The Beeshoek Mine is planned for closure in 2015. In Gabon, mining at the Belinga iron ore deposit could start by 2015. Senegal's Faleme deposit is expected to be mined starting in 2015. In Algeria, increased production would be attributable to the Al-Wenza and the Bou Khadra Mines. Production is also expected to increase in Egypt and Mauritania (table 10).

Gabon and Senegal did not produce iron ore in 2008; their shares of African iron ore production by 2015 are expected to

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be 15% and 9%, respectively. South Africa's share is likely to decline to 61% from 72% in spite of a substantial increase in domestic production (table 10).

Nickel.—*Production.*—African mine production of nickel decreased by 8% in 2008. Output decreased in South Africa and Zimbabwe and increased in Botswana. Most of South Africa's nickel output was a coproduct of PGM mining. In 2008, South Africa accounted for 47% of African nickel mine output; Botswana, 43%; and Zimbabwe, 10% (table 12). Minor tonnages of nickel were recovered as a byproduct of cobalt operations in Morocco.

Outlook.—Nickel mine production is likely to increase by an average of 13% per year from 2008 to 2015. The startup of the Ambatovy nickel and cobalt mine in Madagascar in late 2010 is expected to account for the majority of the increase. Madagascar, which did not mine nickel in 2008, could have a 38% share of African nickel mine production by 2013. Increased output is expected in South Africa because of increased capacity at the Nkomati nickel mine and the opening of the Booysendal, the Mphahlele, and the Pilanesberg PGM mines. In Zambia, Albidon Ltd. plans to start production from the Munali project. Output is expected to decrease in Zimbabwe because of the closure of the Shangani Mine (table 12).

Platinum-Group Metals.—*Production.*—From 2007 to 2008, Africa's production of platinum and palladium decreased by 9% each. In South Africa, production decreases at the Amandelbult, the Bafokeng-Rasimone, the Everest, the Marikana, the Rustenburg, and the Union Mines more than offset increased production at the Elandsfontein, the Kroondal, and the Two Rivers Mines. PGM production increased in Zimbabwe. South Africa, which was the continent's dominant producer of PGM, accounted for 96% and 95% of the production of platinum and palladium, respectively (tables 13, 14).

Outlook.—African mine production of palladium is expected to increase by an average of 4% per year from 2009 to 2015. Platinum mine production is likely to increase by an average of 3% per year from 2009 to 2015. In South Africa, the increase is likely to be attributable to the opening of the Blue Ridge, the Pilansberg, and the Smokey River Mines in 2009; the Kalahari Mine in 2011; the Booysendal, the Grootboom, and the Mphatele Mines in 2012; and the Western Bushveld Project in early 2013. Expansions are planned to be completed at the Nkomati nickel mine in 2011; the Zondereinde Mine in 2012; the Two Rivers Mine in 2013; the Elandsfontein Mine in 2014; and the Marikana Mine in 2015. The Everest Mine is scheduled to reopen in 2010. Output in Zimbabwe could also increase (tables 13, 14; Avery, 2009; Dubbelman, 2010; Pringle, 2010).

Tin.—*Production.*—In 2008, African tin mine production increased by about 31% compared with that of 2007. Increased output in Congo (Kinshasa) was attributable to increased artisanal and small-scale mining activity in Nord-Kivu Province. Production also increased in Rwanda. In 2008, Congo (Kinshasa) accounted for 90% of African tin mine production, and Rwanda, 8% (table 15).

Africa did not produce refined tin in 2008 (table 18). Production of tin metal ceased in Nigeria and Rwanda in 2005 and 2006, respectively.

Outlook.—African tin mine production is expected to increase by about 5% by 2015 because of the expansion of small-scale mining operations in Rwanda and the opening of the Abu Dabbab tin and tantalum mine in Egypt (table 15). Increased output in Egypt and Rwanda is likely to more than offset decreased output in Congo (Kinshasa). African countries are unlikely to open new tin refineries by 2015 because of high energy costs (table 16; Holland, 2009; New Times, 2009).

Zinc.—*Production.*—During 2008, Africa's mine production of zinc increased by about 18%. Production increased in Morocco. In Namibia, production decreased at the Rosh Pinah Mine. Output also decreased at the Black Mountain Mine in South Africa. In 2008, Morocco accounted for 53% of African zinc mine production; Namibia, 21%; South Africa, 16%; and Congo (Kinshasa), 10% (table 17). Africa's share of world zinc mine production was about 2% in 2008 (table 4).

African production of zinc metal decreased by nearly 7% in 2008. Production decreased at the Skorpion smelter in Namibia and at the Zincor smelter in South Africa. Namibia accounted for 55% of continental zinc metal production in 2008; South Africa, 33%; and Algeria, 12% (table 18).

Consumption.—In 2008, world refined zinc consumption increased to 11.5 Mt from 11.3 Mt in 2007. Africa's share of global zinc consumption amounted to about 2% in 2008 (Pitso, 2009).

Outlook.—African zinc mine production is expected to increase by an average of 8% per year from 2008 to 2015. In Algeria, the Tala Hamza zinc project is likely to commence operations by 2011. Algeria, which did not mine zinc in 2008, could account for 34% of continental zinc mine production in 2015. In South Africa, the Pering Mine could reopen in late 2011 (table 17). Continental production of zinc metal is not likely to change significantly from 2008 to 2015 (table 18).

Industrial Minerals

Cement.—*Production.*—In 2008, Africa's production of cement amounted to 128.8 Mt compared with 117.6 Mt in 2007. Most of the increase was attributable to Egypt, Libya, and Morocco. Egypt accounted for 32% of African cement output; Algeria, 14%; Morocco and South Africa, 11% each; and Libya and Tunisia, 6% each.

Consumption.—Africa consumed 150.8 Mt of cement in 2008, which was about 5% of world cement consumption.

Diamond.—*Production.*—In 2008, Africa's share of world diamond production, by volume, was 55%. African diamond production decreased by about 10% in 2008 compared with that of 2007. Congo (Kinshasa) accounted for a majority of the decrease in production, by volume. Société Minière de Bakwanga (MIBA) shut down in 2008 and artisanal miners sought employment in the agricultural sector after many diamond traders shut down operations because of the worldwide economic crisis.

In South Africa, increased output from the opening of the Voorspoed Mine was more than offset by decreased output from the Kimberley, the Namaqualand, and the Venetia Mines. The decrease in Tanzania's production was attributable to the Williamson Mine. In Botswana, the decrease in production from

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the Oropa Mine more than offset the increase in production from the Damtshaa, the Jwaneng, and the Letlhakane Mines. Production by artisanal and small-scale miners decreased in Central African Republic, Ghana, and Sierra Leone. Angola's production also decreased.

In Guinea, production increased sharply because of increased output by artisanal and small-scale miners. Diamond production also increased in Namibia and Zimbabwe. Botswana accounted for 39% of African diamond output by volume; Congo (Kinshasa), 25%; South Africa, 15%; and Angola, 11% (table 19).

In 2008, the global value of rough diamond production amounted to $14.3 billion, of which Africa accounted for more than 60%. Botswana accounted for 24% of the value of global rough diamond output; Angola, 12%; South Africa, 11%; Congo (Kinshasa), 8%; and Namibia, 6%. The global value of polished diamond production amounted to $19.7 billion, of which South Africa accounted for nearly 5% (Even-Zohar, 2009).

In November 2002, the Kimberley Process Certification Scheme (KPCS) was established to reduce the trade in conflict diamond, particularly diamond originating from Angola, Congo (Kinshasa), and Sierra Leone. The establishment of the KPCS involved Government officials from more than 50 countries that produced, processed, and imported diamond as well as representatives from the European Union, the World Diamond Council, and nongovernmental organizations. As of December 2008, the following African countries had met the minimum requirements of the KPCS: Angola, Botswana, Central African Republic, Congo (Brazzaville), Congo (Kinshasa), Ghana, Guinea, Lesotho, Liberia, Mauritius, Namibia, Sierra Leone, South Africa, Tanzania, Togo, and Zimbabwe.

In December 2005, the United Nations Security Council banned the importation of rough diamond from Côte d'Ivoire because of the alleged link between illegal diamond mining and the country's unresolved armed conflict. The ban was still in effect at the end of 2008 (United Nations Security Council, 2005).

Outlook.—The production of rough diamond in Africa is expected to decrease by 9% by 2011 because of the worldwide financial crisis, and then to increase by an average of between 3% and 4% per year from 2011 to 2015. Angola's production is likely to more than double because of the opening of new mines and increased output from existing mines. In Tanzania, the Williamson Mine is likely to close in 2010 and reopen at higher levels of production in 2013. Production could also increase in Zimbabwe by 2011. In South Africa, reduced production at the Namaqualand and the Venetia Mines is expected to more than offset increased production from the Cullinan and the Voorspoed Mines. Production is also likely to decrease at the De Beers Group's operations in Botswana (table 19).

Lithium.—*Production.*—Zimbabwe was Africa's only producer of lithium minerals. In 2008, production decreased by about 17% (table 20).

Outlook.—No change is expected in Zimbabwe's lithium mineral production from 2008 to 2015 (table 20).

Mineral Fuels and Related Materials

Coal.—*Production.*—African coal production increased by nearly 2% in 2008. In South Africa, increased output was partially attributable to increased production at the Leeuwpan Mine and the North Block Complex and the opening of the Inyanda Mine. Output increased in Botswana and decreased in Zimbabwe. South Africa, which was the dominant coal producer in Africa, accounted for 98% of regional coal output; and Zimbabwe, 1% (table 21). More than 99% of South Africa's coal production was bituminous. Africa accounted for about 5% of total world anthracite and bituminous coal production in 2008.

Consumption.—Africa accounted for about 3% of world coal consumption in 2008. Within the region, South Africa accounted for 92% of African coal consumption. From 2003 to 2008, Africa's consumption of coal increased by about 15% (BP p.l.c., 2009, p. 35).

Outlook.—African coal production is expected to increase by between 5% and 6% per year from 2008 to 2015. South Africa is likely to be responsible for the majority of the increase; its production could increase to 349 Mt by 2015 (table 21). Increased output would be attributable to the opening of the Makhado, the Mooiplaats, and the Vele Mines in 2009; the Boshmanspoort Mine in 2010; the New Largo and the Vlakfontein Mines in 2012; the Elders Opencast, the Elders Underground, and the Heidelberg Underground Mines in 2013; and the Thabametsi Mine in 2014, and to the expansions of the Forzando South Mine in 2009; the Klipspruit Mine in 2010; the Goedgevonden Mine in 2011; and the Grootegeluk Mine from 2011 to 2015 (table 21; Cornish, 2009; Ruffini, 2009; Tex Report, The, 2009; Ryan, 2010; Thomson Reuters, 2010; Continental Coal Ltd., undated).

Mozambique is expected to become the second ranked coal producer in Africa with the opening of the Benga and the Moatize Mines in late 2010. Tanzania is likely to become the fourth ranked producer with the opening of the Ngaka Mine in late 2011. In Zimbabwe, output could increase at Hwange Colliery by 2013 if economic and political stability are restored (table 21; Theunissen, 2009).

Uranium.—*Production.*—In 2008, African uranium mine production increased by 16% compared with that of 2007. In Namibia, output increased at the Langer Heinrich and the Rossing Mines. The increase in South Africa's production was limited by the closure of the Dominion Mine in late 2008. Output decreased in Niger. In 2008, Namibia accounted for 55% of African uranium production; Niger, 38%; and South Africa, 7% (table 22). Africa accounted for about 19% of the world's uranium production in 2008 (table 4).

Consumption.—South Africa was the only regional consumer of uranium in 2008. Africa accounted for less than 1% of the electricity generated worldwide by nuclear power (BP p.l.c., 2009, p. 36).

Outlook.—Continental uranium mine production is expected to increase by about 280% from 2008 to 2015. In Niger, the new Imouraren Mine is likely to open in 2012. Niger's share of African uranium mine production is likely to decrease to 27% from 38% in spite of nearly tripling from 2008 to 2015 because of increased output in other African countries (table 22).

In Namibia, production at the Langer Heinrich and the Rossing Mines is planned to increase by 2011 and 2013, respectively. The new Trekkopje Mine is likely to open by 2011; the Valencia Mine, by 2013; and the Husab Mine, by

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2015. In South Africa, the Ezulwini Mine is expected to start production in 2011; the Buffelsfontein Tailings Project, in 2012; and the Cooke Uranium project, in 2013. AngloGold Ashanti Ltd. planned to increase uranium output from its South African gold mines by about 36% by 2010. The Kayelekera Mine in Malawi is expected to reach full capacity in 2010 after starting operations in 2009, and the Kanyika niobium mine could start uranium production in early 2013. Africa's share of world uranium mine production could increase significantly by 2015 [table 22; Rand Uranium (Pty) Ltd., 2010].

Trade Review and Outlook

Africa's current account surplus amounted to 2.5% of the GDP in 2008 compared with a revised 2.9% of the GDP in 2007. In 2008, countries in the Arab Maghreb Union ran an average surplus of 10.6% of the GDP, and sub-Saharan countries ran an average surplus of 0.2% of the GDP. Trade surpluses in oil-exporting countries more than offset trade deficits in oil-importing countries. Oil-importing countries had an average current account deficit of 7.1% of the GDP in 2008, and oil-exporting countries had an average current account surplus of 14.9% of the GDP (International Monetary Fund, 2009, p. 90).

The average current account deficit for oil-importing countries is expected to be 5.7% of the GDP in 2009 and 7.3% of the GDP in 2010. For oil-exporting countries, the surplus is predicted to be 0.9% of the GDP in 2009 and 6.2% of the GDP in 2010. Africa is expected to run a current account deficit of 3.1% of the GDP in 2009 and 1.7% of the GDP in 2010 (International Monetary Fund, 2009, p. 90).

Africa's natural gas exporters included Algeria, which accounted for 51% of the continent's natural gas exports; Nigeria, 18%; Libya, 15%; Egypt, 9%; and Equatorial Guinea, 4%. Europe received 75% of African total natural gas exports and was the destination for 85% of Africa's natural gas exports by pipeline and 66% of Africa's liquefied natural gas (LNG) exports. Countries of the Asia and the Pacific region received 15% of total African natural gas exports; intraregional exports to other Africa countries accounted for only 4% (BP p.l.c., 2009, p. 30).

In 2008, Europe received 37% of Africa's petroleum exports; the United States, 30%; China, 13%; India, 5%; and other countries in the Asia and the Pacific region, 4%. West African countries sent 40% of their exports to the United States and 28% to China, India, and other countries in the Asia and the Pacific region. North African countries sent 63% of their exports to Europe and 20% to the United States. Intraregional exports to African countries amounted to only 1% of total African petroleum exports (BP p.l.c., 2009, p. 20).

Intraregional mineral trade was, however, significant for gold. South Africa imported gold, mostly from West African countries, to supply its gold refinery. A majority of African gold mine production was refined in South Africa before being exported to other regions. Most of Africa's copper and PGM production was also exported in refined form. The majority of Africa's chromite production was processed into ferrochromium prior to export. For other commodities, which included bauxite, colored gemstones, diamond, iron ore, niobium (columbium), petroleum, tantalum, tin, tungsten, and uranium, most of or all of the continent's production was exported prior to downstream processing.

Environment

Deforestation for fuel use and land-intensive agricultural production continued to be a significant environmental issue in many African countries. Other causes of deforestation included artisanal production of gemstones, lime, and sand and gravel. The use of mercury by artisanal gold miners has led to serious air and water pollution in such African countries as Ghana, Kenya, Mozambique, South Africa, Sudan, Tanzania, and Zimbabwe. The flaring of natural gas in Nigeria has led to air pollution and emissions of greenhouse gases.

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TABLE 1
AFRICA: AREA AND POPULATION IN 2008

Country	Area[1] (square kilometers)	Estimated population[2] (thousands)
Algeria	2,381,741	34,362
Angola	1,246,700	18,021
Benin	112,622	8,662
Botswana	581,730	1,905
Burkina Faso	274,200	15,209
Burundi	27,830	8,074
Cameroon	475,440	18,898
Cape Verde	4,033	499
Central African Republic	622,984	4,423
Chad	1,284,000	11,067
Comoros	2,235	644
Congo (Brazzaville)	342,000	3,615
Congo (Kinshasha)	2,344,858	64,205
Côte d'Ivoire	322,463	20,591
Djibouti	23,200	848
Egypt	1,001,450	81,527
Equatorial Guinea	28,051	659
Eritrea	117,600	4,996
Ethiopia	1,104,300	80,713
Gabon	267,667	1,448
Gambia, The	11,295	1,660
Ghana	238,533	23,351
Guinea	245,857	9,833
Guinea-Bissau	36,125	1,575
Kenya	580,367	38,534
Lesotho	30,355	2,017
Liberia	111,369	3,793
Libya	1,759,540	6,277
Madagascar	587,041	19,111
Malawi	118,484	14,278
Mali	1,240,192	12,711
Mauritania	1,030,700	3,200
Mauritius	2,040	1,269
Mayotte	374	191
Morocco	446,550	31,229
Mozambique	799,380	21,781
Namibia	824,292	2,114
Niger	1,267,000	14,669
Nigeria	923,768	151,319
Reunion	2,517	NA
Rwanda	26,338	9,721
Sao Tome e Principe	964	161
Senegal	196,722	12,211
Seychelles	455	86
Sierra Leone	71,740	5,560
Somalia	637,657	8,954
South Africa	1,219,090	48,687
Sudan	2,505,813	41,348
Swaziland	17,364	1,168
Tanzania	947,300	42,484
Togo	56,785	6,459
Tunisia	163,610	10,327
Uganda	241,038	31,657

See footnotes at end of table.

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TABLE 1—Continued
AFRICA: AREA AND POPULATION IN 2008

Country	Area[1] (square kilometers)	Estimated population[2] (thousands)
Western Sahara	266,000	405
Zambia	752,618	12,620
Zimbabwe	390,757	12,463
Total	30,288,134	983,589
World	148,940,000	6,692,030

NA Not available.
[1]Source: Central Intelligence Agency, The World Factbook 2009.
[2]Source: The World Bank, 2008 World Development Indicators Database.

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TABLE 2
AFRICA: GROSS DOMESTIC PRODUCT[1, 2]

Country	Gross domestic product based on purchasing power parity		Real gross domestic product growth rate (percentage)		
	Gross value (billion dollars)	Per capita (dollars)	2006	2007	2008
Algeria	$233.4	$6,709	2.0	3.0	3.0
Angola	105.1	6,252	18.6	20.3	13.2
Benin	13.0	1,608	3.8	4.6	5.0
Botswana	26.6	14,907	5.1	4.4	2.9
Burkina Faso	17.8	1,268	5.5	3.6	5.0
Burundi	3.1	390	5.1	3.6	4.5
Cameroon	41.5	2,139	3.2	3.3	2.9
Cape Verde	1.7	3,472	10.8	7.8	5.9
Central African Republic	3.2	740	3.8	3.7	2.2
Chad	16.2	1,663	0.2	0.2	-0.2
Comoros	0.8	1,157	1.2	0.5	1.0
Congo (Brazzaville)	14.3	3,919	6.2	-1.6	5.6
Congo (Kinshasha)	20.7	330	5.6	6.3	6.2
Côte d'Ivoire	34.1	1,643	0.7	1.6	2.3
Djibouti	1.9	2,396	4.8	5.1	5.8
Egypt	443.4	5,897	6.8	7.1	7.2
Equatorial Guinea	22.4	18,058	1.3	21.4	11.3
Eritrea	3.7	748	-1.0	1.3	1.0
Ethiopia	71.1	898	11.5	11.5	11.6
Gabon	21.1	14,545	1.2	5.6	2.3
Gambia, The	2.3	1,395	6.5	6.3	6.1
Ghana	34.2	1,518	6.4	5.7	7.3
Guinea	10.4	1,014	2.5	1.8	4.9
Guinea-Bissau	0.8	486	0.6	2.7	3.3
Kenya	60.4	1,712	6.4	7.1	1.7
Lesotho	3.2	1,305	8.1	5.1	3.5
Liberia	1.5	373	7.8	9.4	7.1
Libya	88.1	14,192	6.7	7.5	3.4
Madagascar	20.1	996	5.0	6.2	7.1
Malawi	11.4	836	6.7	8.6	9.7
Mali	15.1	1,129	5.3	4.3	5.1
Mauritania	6.2	2,055	11.4	1.0	2.2
Mauritius	15.3	12,011	3.5	4.2	6.6
Mayotte	1.0 [3, 4]	4,900 [3, 4]	NA	NA	NA
Morocco	137.1	4,362	7.8	2.7	5.6
Mozambique	18.7	903	8.7	7.0	6.8
Namibia	13.7	6,612	7.1	5.5	2.9
Niger	10.2	740	5.8	3.3	9.5
Nigeria	319.6	2,162	6.2	7.0	6.0
Reunion	NA	NA	NA	NA	NA
Rwanda	10.0	1,043	7.3	7.9	11.2
Sao Tome e Principe	0.3	1,752	6.7	6.0	5.8
Senegal	21.8	1,739	2.4	4.7	2.5
Seychelles	1.8	20,829	8.3	7.3	-1.9
Sierra Leone	4.3	725.0	5.1	6.4	5.5
Somalia	5.6 [3]	600.0 [3]	2.6	2.6	2.6
South Africa	493.5	10,136.0	5.3	5.1	3.1
Sudan	88.0	2,309.1	11.3	10.2	6.8
Swaziland	5.9	5,749.3	2.9	3.5	2.4
Tanzania	53.8	1,353.5	6.7	7.1	7.4
Togo	5.4	811.5	3.9	1.9	1.1
Tunisia	82.6	8,002.2	5.4	6.3	4.6
Uganda	36.7	1,146.8	10.8	8.4	9.0

See footnotes at end of table.

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TABLE 2—Continued
AFRICA: GROSS DOMESTIC PRODUCT[1, 2]

Country	Gross domestic product based on purchasing power parity		Real gross domestic product growth rate (percentage)		
	Gross value (billion dollars)	Per capita (dollars)	2006	2007	2008
Western Sahara	0.9 [3, 5]	2,500.0 [3, 5]	NA	NA	NA
Zambia	17.4	1,482.2	6.2	6.3	5.8
Zimbabwe	2.2 [5]	189.0 [5]	-6.3	-6.9	-14.1
Total	2,461.3	2,500			
World total	69,489,850				

NA Not available.
[1]Source: International Monetary Fund, World Economic Outlook Database, October 2009.
[2]Gross domestic product listed may differ from that reported in individual country chapters owing to differences in source or date of reporting.
[3]Source: U.S. Central Intelligence Agency, The World Factbook 2009.
[4]2005 estimate.
[5]2007 estimate.

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TABLE 3
SELECTED SIGNIFICANT AFRICAN EXPLORATION SITES IN 2008

Country	Type[1]	Site	Commodity[2]	Company	Resource[2, 3]	Exploration[4]
Burkina Faso	E	Bombore	Au	Orezone Resource Ltd.	937,000 oz Au	Extensive drilling.
Cameroon	E	Mbalam	Fe	Sundance Resources Ltd.	134 Mt Fe (inferred)	Do.
Congo (Kinshasa)	E	Kasala	Cu	El Nino Ventures Inc.	Data not released	Do.
Do.	F	Moto	Au	Moto Goldmines Ltd.	11.2 Moz Au	Extensive work program.
Do.	D	Tenke Fungurume	Cu, Co	Freeport McMoRan Copper & Gold Inc.	2.3 Mt Cu, 357,000 t Co	Do.
Do.	F	Twangiza	Au	Banro Corp.	5.6 Moz Au	Do.
Côte d'Ivoire	E	Tengrela	Au	Perseus Mining Ltd.	388,000 oz Au	Extensive drilling.
Egypt	D	Sukari	Au	Centramin Egypt Ltd.	9.4 Moz Au	Do.
Ghana	F	Ayanfuri	Au	Perseus Mining Ltd.	3.15 Moz Au	Do.
Do.	E	Sian	Au	Midlands Minerals Corp.	192,000 oz Au	Do.
Guinea	E	Koba	Bauxite	Navasota Resource Ltd.	147 Mt Al_2O_3	Do.
Mauritania	P	Tasiast	Au	Red Back Mining Inc.	1.95 Moz Au	Do.
Namibia	E	Entango	U	Bannerman Resource Ltd.	40,500 t U_3O_8	Do.
Do.	E	Husab/Ida Dome	U	Extract Resources Ltd.	150 t U_3O_8	Do.
Do.	E	Husab/Rossing South	U	do.	49,000 t U_3O_8	Do.
Do.	P	Navachab	Au	AngloGold Ashanti Ltd.	1.3 Moz Au	Extensive work program.
Do.	E	Reptile	U	Deep Yellow Ltd.	Data not released	Extensive drilling.
South Africa	E	Garatau/Tubatse	PGM, Au	Nkwe Platinum Ltd.	2.7 Moz 3PGM+Au	Do.
Do.	F	Mphahlele	PGM, Au	Platmin Ltd.	6.6 Moz 5PGM+Au	Extensive work program.
Tanzania	E	Buckreef	Au	IAMGOLD Corp.	1 Moz Au	Do.
Do.	E	Kabanga	Ni, Cu, Co, PGM	Barrick Gold Corp.	219,000 t Ni, 30,000 t Cu, 18,000 t Co	Extensive drilling.
Zambia	E	Cheowa/Kangaluwi	Cu, Au	Zambezi Resources Ltd.	40,000 t Cu, 26,000 oz Au	Do.
Do.	F	Konkola North	Cu	Teal Exploration & Mining Inc.	1.2 Mt Cu	Do.
Do.	F	Mutanga	U	Denison Mines Corp.	2,500 t U_3O_8	Do.

Do., do. Ditto.

[1]D—Approved for development; E—Active exploration; F—Feasibility work ongoing/completed; P—Exploration related to existing producing operation.

[2]Abbreviations used in this table for commodities include the following: Al_2O_3, aluminum oxide; Au, gold; Co, cobalt; Cu, copper, Fe, iron; Ni, nickel; PGM, platinum-group metals; 3PGM+Au, Includes palladium, platinum, rhodium, and gold; 5PGM+Au, Includes palladium, platinum, rhodium, ruthenium, iridium, and gold; U, uranium; U_3O_8, uranium oxide.

Abbreviations used in this table for units of measure include the following: Moz, million troy ounces; Mt, million metric tons; oz, troy ounces; t, metric tons.

[3]Based on 2008 data reported from various sources, values vary from measured reserves to identified resources. Resources are reported at the indicated level unless otherwise specified. Resource data not verified by the U.S. Geological Survey.

[4]Sites where extensive (greater than 10,000 meters) drilling or significant (more than US$5 million) expenditures have been reported.

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TABLE 4

AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Metals									
	Aluminum			Cobalt,			Iron and steel		Lead,	Manganese
Country	Bauxite	Metal[2]	Chromite, mine output, gross weight	mine output, Co content (metric tons)	Copper, mine output, Cu content	Gold, mine output (kilograms)	Iron ore, gross weight	Steel, crude	mine output, Pb content (metric tons)	ore, mine output, Mn content
Algeria	--	--	--	--	--	647	2,077	646	--	--
Angola	--	--	--	--	--	--	--	--	--	--
Benin	--	--	--	--	--	20	--	--	--	--
Botswana	--	--	--	--	22 e	3,176	--	--	--	--
Burkina Faso	--	--	--	--	--	7,633 [3]	--	--	--	--
Burundi	--	--	--	--	--	750	--	--	--	--
Cameroon	--	91 e	--	--	--	1,800 e	--	--	--	--
Cape Verde	--	--	--	--	--	--	--	--	--	--
Central African Republic	--	--	--	--	--	10 e	--	--	--	--
Chad	--	--	--	--	--	150 e	--	--	--	--
Comoros	--	--	--	--	--	--	--	--	--	--
Congo (Brazzaville)	--	--	--	--	--	100 e	--	--	--	--
Congo (Kinshasa)	--	--	--	31,000 e	243 e	3,300 e	--	113	--	--
Côte d'Ivoire	--	--	--	--	--	4,205	--	--	--	76
Djibouti	--	--	--	--	--	--	--	--	--	--
Egypt	--	260	--	--	--	--	1,811	6,198	--	3
Equatorial Guinea	--	--	--	--	--	200 e	--	--	--	--
Eritrea	--	--	--	--	--	32	--	--	--	--
Ethiopia	--	--	--	--	--	3,465	--	110 e	--	--
Gabon	--	--	--	--	--	300 e	--	--	--	1,549
Gambia, The	--	--	--	--	--	--	--	--	--	--
Ghana	738	--	--	--	--	80,503	--	--	--	380 e
Guinea	17,200	--	--	--	--	19,945 [4]	--	--	--	--
Guinea-Bissau	--	--	--	--	--	--	--	--	--	--
Kenya	--	2 e	--	--	--	340	(5) e	--	--	--
Lesotho	--	--	--	--	--	--	--	--	--	--
Liberia	--	--	--	--	--	624	--	--	--	--
Libya	--	--	--	--	--	--	--	1,137	--	--
Madagascar	--	--	84	--	--	72	--	--	--	--
Malawi	--	--	--	--	--	--	--	--	--	--
Mali	--	--	--	--	--	41,160	--	--	--	--
Mauritania	--	--	--	--	33	6,254	10,950	1,598	--	--
Mauritius	--	--	--	--	--	--	--	--	--	--
Morocco and Western Sahara	--	--	--	1,000 e	6 e	1,600 e	9 e	478	33,500 e	3 e
Mozambique	5 e	536	--	--	--	298	--	--	--	--

See footnotes at end of table.

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TABLE 4—Continued
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Metals—Continued									
	Aluminum		Chromite, mine output, gross weight	Cobalt, mine output, Co content (metric tons)	Copper, mine output, Cu content	Gold, mine output (kilograms)	Iron and steel		Lead, mine output, Pb content (metric tons)	Manganese ore, mine output, Mn content
Country	Bauxite	Metal[2]					Iron ore, gross weight	Steel, crude		
Namibia	--	--	--	--	7	2,126	--	--	14,062	10 e
Niger	--	--	--	--	--	2,314	--	--	--	--
Nigeria	--	20	--	--	--	200 e	62	500 e	57,960	--
Reunion	--	--	--	--	--	--	--	--	--	--
Rwanda	--	--	--	--	--	20 e	--	--	--	--
Sao Tome e Principe	--	--	--	--	--	--	--	--	--	--
Senegal	--	--	--	--	--	600 e	--	--	--	--
Seychelles	--	--	--	--	--	--	--	--	--	--
Sierra Leone	954	--	--	--	--	196	--	--	--	--
Somalia	--	--	--	--	--	--	--	--	--	--
South Africa	--	811	9,682	400 e	109	212,744	48,983	8,550	46,440	2,900
Sudan	--	--	15 e	--	--	2,276	--	--	--	(5)
Swaziland	--	--	--	--	--	--	--	--	--	--
Tanzania	5 e	--	--	--	3 e	36,000 e	--	--	--	--
Togo	--	--	--	--	--	--	--	--	--	--
Tunisia	--	--	--	--	--	--	211	82	--	--
Uganda	--	--	--	--	--	20 e	(5) e	30 e	--	--
Zambia[e]	--	--	--	6,900	583	1,930	--	--	--	1
Zimbabwe	--	--	650 e	50 e	2 e	3,600 e	50 e	60 e	--	--
Total	18,900	1,720	10,400	39,400	1,010	439,000	64,200	19,500	152,000	4,920
Share of world total	9%	4%	37%	52%	6%	22%	3%	1%	4%	35%
United States	NA	2,660	--	--	1,310	233,000	53,600	91,900	410,000	--
Share of world total	NA	6%	--	--	8%	12%	2%	7%	10%	--
World total	213,000	47,400	28,000	75,000	15,500	1,970,000	2,210,000	1,330,000	3,970,000	14,100

See footnotes at end of table.

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TABLE 4—Continued
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

Country	Metals—Continued Zinc, mine output, Zn content (metric tons)	Industrial minerals Cement, hydraulic	Diamond, natural (thousand carats)[6]	Graphite (metric tons)	Phosphate rock, gross weight	Coal, anthracite and bituminous	Mineral fuels Petroleum, crude (thousand 42-gallon barrels)	Uranium, U_3O_8 content (metric tons)
Algeria	--	17,397	--	--	1,805	--	727,445	--
Angola	--	1,780	8,907 [7, 8]	--	--	--	684,375	--
Benin	--	1,500	--	--	--	--	--	--
Botswana	--	--	32,595 [9]	--	--	910	--	--
Burkina Faso	--	30 e	--	--	2 e	--	--	--
Burundi	--	--	--	--	--	--	--	--
Cameroon	--	1,000	12 e	--	--	--	31,000 e	--
Cape Verde	--	160 e	--	--	--	--	--	--
Central African Republic	--	--	377	--	--	--	--	--
Chad	--	--	--	--	--	--	49,400 e	--
Comoros	--	--	--	--	--	--	--	--
Congo (Brazzaville)	--	100 e	110	--	--	--	85,037	--
Congo (Kinshasa)	18,000	411 e	20,947	--	--	116	8,000	--
Côte d'Ivoire	--	650 e	300 e	--	--	--	22,000 e	--
Djibouti	--	--	--	--	--	--	--	--
Egypt	--	39,844	--	--	5,523	360 e	240,990	--
Equatorial Guinea	--	--	--	--	--	--	120,000 e	--
Eritrea	--	45 e	--	--	--	--	--	--
Ethiopia	--	1,834	--	--	--	--	--	--
Gabon	--	230	1 e	--	--	--	85,775	--
Gambia, The	--	--	--	--	--	--	--	--
Ghana	--	1,800 e	643	--	--	--	--	--
Guinea	--	360 e	3,098	--	--	--	--	--
Guinea-Bissau	--	--	--	--	--	--	--	--
Kenya	--	3,135	--	--	--	--	--	--
Lesotho	--	--	450 e	--	--	--	--	--
Liberia	--	94 p	61	--	--	--	--	--
Libya	--	8,000 e	--	--	--	--	643,600	--
Madagascar	--	460	--	5,000 e	--	--	14 e	--
Malawi	--	240	--	--	--	60 e	--	--
Mali	--	--	--	--	--	--	--	--
Mauritania	--	322	--	--	--	--	4,422	--
Mauritius	--	--	--	--	--	--	--	--
Morocco and Western Sahara	96,900 e	14,047	--	--	25,000 e	--	250 e	--
Mozambique	--	730 e	--	--	--	38 e	--	--

See footnotes at end of table.

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TABLE 4—Continued
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

Country	Metals—Continued	Industrial minerals					Mineral fuels	
	Zinc, mine output, Zn content (metric tons)	Cement, hydraulic	Diamond, natural (thousand carats)[6]	Graphite (metric tons)	Phosphate rock, gross weight	Coal, anthracite and bituminous	Petroleum, crude (thousand 42-gallon barrels)	Uranium, U_3O_8 content (metric tons)
Namibia	38,319 e	--	2,435	--	--	--	--	5,074
Niger	--	40 e	--	--	--	183	--	3,575
Nigeria	--	5,000 e	--	--	--	500 e	768,800	--
Reunion	--	400 e	--	--	--	--	--	--
Rwanda	--	103	--	--	--	--	--	--
Sao Tome e Principe	--	--	--	--	--	--	--	--
Senegal	--	3,084	--	--	645	--	99	--
Seychelles	--	--	--	--	--	--	--	--
Sierra Leone	--	254	371	--	--	--	--	--
Somalia	--	--	--	--	--	--	--	--
South Africa	29,002	13,323	12,901	--	2,287	252,213	1,976	654
Sudan	--	330 e	--	--	--	--	168,898	--
Swaziland	--	--	--	--	--	175	--	--
Tanzania	--	1,756	180 e, 10	--	8 e	27 e	--	--
Togo	--	800 e	9	--	842	--	--	--
Tunisia	--	7,875	--	--	7,692	--	31,732	--
Uganda	--	650 e	--	--	--	--	--	--
Zambia e	--	700	--	--	--	220	--	--
Zimbabwe	--	400 e	797	2,000 e	30 e	2,000 e	--	--
Total	182,000	129,000	84,200	7,000	43,800	257,000	3,670,000	9,300
Share of world total	2%	5%	55%	1%	27%	5%	12%	19%
United States	778,000	87,600	--	--	30,200	994,000	6,620,000	1,770
Share of world total	7%	3%	--	--	18%	17%	22%	4%
World total	11,300,000	2,840,000	153,000	1,110,000	165,000	5,680,000	30,200,000	49,400

[e]Estimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. [p]Preliminary. NA Not available. -- Zero or zero percent.

[1]Totals may not add owing to independent rounding. Percentages are calculated on unrounded data. Table includes data available through June 21, 2010.

[2]Primary and secondary production.

[3]Includes artisanal mining, which was estimated to be 1,600 kilograms.

[4]Does not include artisanal mining production, which has historically ranged between 1,500 and 5,000 kilograms per year.

[5]Less than 1/2 unit.

[6]Gemstones and industrial diamond.

[7]Does not include smuggled production.

[8]Production was approximately 90% gem and 10% industrial grade.

[9]Assumed to contain about 70% gem and near gem.

[10]Diamond figures are estimated to represent 85% gem-quality or semigem-quality and 15% industrial-quality stones. Does not include smuggled artisanal production.

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TABLE 5
AFRICA: HISTORIC AND PROJECTED BAUXITE PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Ghana	513	504	727	738	800	850	850
Guinea	15,800	15,700	14,600	17,200	17,200	17,200	17,200
Mozambique	11	8	10	5	5	5	5
Sierra Leone	--	--	--	954	960	960	960
Tanzania	--	--	2	5	5	5	5
Total	16,300	16,200	15,300	18,900	19,000	19,000	19,000

[e]Estimated. -- Negligible or no production.
[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 6
AFRICA: HISTORIC AND PROJECTED ALUMINUM PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Cameroon	79	86	87	91	90	90	90
Egypt	180	189	244	260	320	320	320
Ghana	135	137	--	--	--	120	200
Kenya[2]	2	2	2	2	2	2	2
Mozambique	--	54	555	536	550	550	550
Nigeria	--	--	--	20	22	197	197
South Africa	229	673	846	811	810	810	810
Total	630	1,100	1,700	1,700	1,800	2,100	2,200

[e]Estimated. -- Negligible or no production.
[1]Estimated data and totals are rounded to no more than three significant digits.
[2]Kenya produced secondary refined aluminum; primary production in all other African aluminum-producing countries.

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TABLE 7

AFRICA: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1995-2015[1]

(Metal content in thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Botswana	25	35	31	22	24	28	30
Congo (Kinshasa)	29	31	97	243	583	645	762
Eritrea	--	--	--	--	--	81	73
Mauritania	--	--	--	33	30	30	30
Morocco	14	7	4	6	6	6	6
Namibia	23	6	10	7	--	--	--
South Africa	166	137	89	109	113	116	117
Tanzania[2]	--	--	4	3	7	7	7
Zambia	316	249	447	583	800	800	800
Zimbabwe	9	2	3	2	2	2	2
Total	580	470	690	1,000	1,600	1,700	1,800

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Copper contained in concentrates and doré.

TABLE 8

AFRICA: HISTORIC AND PROJECTED REFINED COPPER PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Congo (Kinshasa)	35	--	--	46	408	490	655
Egypt[2]	4	4	14	12	12	12	12
South Africa	124	126	99	93	90	91	91
Zambia	328	227	399	400	500	500	500
Zimbabwe	7	10	7	3	7	7	7
Total	500	370	520	550	1,000	1,100	1,300

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Egypt produced secondary refined copper; primary production in all other African countries.

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TABLE 9

AFRICA: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Algeria	--	--	637	647	1,100	1,100	1,100
Benin[2]	300	--	20	20	20	20	20
Botswana	86	4	2,709	3,176	1,700	1,700	--
Burkina Faso	1,319	625	1,397	7,633	8,700	9,400	9,400
Burundi	2,000	--	750	750	750	750	750
Cameroon[2]	800	1,000	1,889	1,800	3,000	3,000	3,000
Central African Republic	97	15	15	10	4,100	6,900	6,300
Chad	--	120	150	150	50	50	50
Congo (Brazzaville)	10	10	120	100	100	100	100
Congo (Kinshasa)	1,180	69	7,200	3,300	3,400	18,600	32,000
Côte d'Ivoire	1,983	3,444	1,335	4,205	12,100	15,700	15,100
Egypt	--	--	--	--	6,200	6,200	6,200
Equatorial Guinea	50	500	200	200	200	200	200
Eritrea	59	264	25	32	34	34	30
Ethiopia	4,500	3,206	4,376	3,465	4,900	7,100	5,700
Gabon	70	70	300	300	300	300	300
Ghana	53,087	72,080	66,852	80,503	85,100	88,200	88,200
Guinea	7,863	15,788	25,097	19,945	18,500	18,500	18,500
Kenya	170	1,243	616	340	340	340	340
Liberia	800	25	27	624	650	650	650
Madagascar	38	5	10	72	70	70	70
Mali	3,996	28,717	44,230[3]	41,160[4]	42,100[4]	43,000[4]	43,000[4]
Mauritania	1,196	--	--	6,254	10,500	10,500	10,500
Morocco	580	505	1,786	1,600	1,600	1,600	1,600
Mozambique	6,800	23	63	298	820	820	820
Namibia	2,394	2,417	2,703	2,126	2,200	2,200	2,200
Niger	1,000	25	4,962	2,314	2,300	2,300	2,300
Nigeria	5	52	30	200	200	200	200
Rwanda	26	10	10	20	20	20	20
Senegal	--	550	600	600	5,300	5,300	5,300
Sierra Leone	4	--	53	196	200	200	200
South Africa	523,809	430,800	294,671	212,744	239,000	257,000	274,000
Sudan	3,700	5,774	3,625	2,276	2,100	--	--
Tanzania	320	15,060	47,270	36,000	44,100	40,000	38,600
Uganda	1,506	56	46	20	20	20	20
Zambia	91	600	440	1,930	2,000	2,000	2,000
Zimbabwe	23,959	22,069	14,024	3,600	10,000	20,000	20,000
Total	644,000	605,000	528,000	439,000	514,000	560,000	590,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]From artisanal mining.

[3]Excludes production from artisanal mining, which is estimated to be about 4,000 kilograms per year.

[4]Excludes production from artisanal mining, which is estimated to be about 5,000 kilograms per year.

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TABLE 10

AFRICA: HISTORIC AND PROJECTED IRON ORE MINE PRODUCTION, 1995-2015[1]

(Fe content in thousand metric tons)

Country	Average grade	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Algeria	50%	1,100	820	800	1,039	1,500	1,500	1,500
Egypt	55%	1,120	1,900	880	996	1,600	1,600	1,600
Gabon	64%	--	--	--	--	--	--	11,500
Mauritania	59% to 72%	7,000	7,500	7,000	7,120	8,000	8,500	8,500
Morocco	54%	32	4	4	5	5	4	4
Nigeria	36%	62	9	20	20	--	--	50
Senegal	42% to 59%	--	--	--	--	--	--	7,500
South Africa	62% to 65%	19,800	21,570	24,900	30,800	38,800	48,500	48,200
Tanzania	32%	14	--	--	--	--	--	--
Tunisia	54%	122	98	108	110	100	100	100
Uganda	61% to 67%	--	3	--	(3)	(3)	(3)	(3)
Zimbabwe[2]	51%	160	225	185	25	--	100	200
Total		29,400	32,100	34,600	40,100	50,000	60,300	79,200

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more that three significant digits.

[2]Average iron content for Zimbabwe prior to 1996 was 61%. Since 1996, the average grade has been 51%.

[3]Less than 1 unit.

TABLE 11

AFRICA: HISTORIC AND PROJECTED STEEL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Algeria	827	842	1,007	646	1,500	1,500	1,500
Congo (Kinshasa)	NA	159	110	113	110	110	110
Egypt	2,642	2,838	5,565	6,198	8,000	8,000	8,000
Ethiopia	NA	NA	60	110	110	110	110
Kenya	20	--	--	--	--	--	--
Libya	909	1,055	1,255	1,137	2,000	2,000	2,000
Mauritania	NA	5	1,263	1,598	2,000	2,000	2,000
Morocco	7	5	205	478	500	500	500
Nigeria	36	--	100	500	500	500	1,200
South Africa	8,741	8,481	9,494	8,550	8,100	8,100	8,100
Tunisia	201	237	66	82	220	240	250
Uganda	12	7	30	30	30	30	30
Zimbabwe	210	258	107	60	60	200	400
Total	13,600	13,900	19,300	19,500	23,000	23,000	24,000

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

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TABLE 12

AFRICA: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1995-2015[1]

(Metal content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Botswana	18,088	38,420	39,305	28,940	28,000	28,000	28,000
Madagascar	--	--	--	--	20,000	60,000	60,000
Morocco	NA	84	99	80	80	80	80
South Africa	30,700	36,616	42,392	31,675	47,800	54,500	56,800
Zambia	--	--	--	--	6,000	6,000	9,000
Zimbabwe	11,721	8,160	8,556	6,354	8,000	8,000	5,000
Total	60,500	83,300	90,400	67,000	110,000	157,000	159,000

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 13

AFRICA: HISTORIC AND PROJECTED PLATINUM MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Ethiopia	--	--	--	10	10	10	10
South Africa	102,300	114,459	163,711	146,141	157,000	170,000	181,000
Zimbabwe	7	505	4,834	5,642	8,000	10,000	10,000
Total	102,000	115,000	169,000	152,000	165,000	180,000	190,000

[e]Estimated. --Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 14

AFRICA: HISTORIC AND PROJECTED PALLADIUM MINE PRODUCTION, 1995-2015[1]

(Metal content in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
South Africa	51,000	55,818	82,961	75,537	84,400	92,500	98,300
Zimbabwe	17	366	3,879	4,386	6,000	8,000	8,000
Total	51,000	56,200	86,800	79,900	90,400	100,000	106,000

[e]Estimated.

[1]Estimated data and totals are rounded to no more than three significant digits.

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TABLE 15

AFRICA: HISTORIC AND PROJECTED TIN MINE PRODUCTION, 1995-2015[1]

(Metal content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Burundi	15	6	4	21	20	20	20
Congo (Kinshasa)	--	50	4,400	11,800	9,400	9,400	9,400
Egypt	--	--	--	--	1,530	1,530	1,530
Niger	20	22	14	10	10	10	10
Nigeria	250	2,760	1,300	185	200	200	200
Rwanda	242	276	170	1,100	1,200	1,200	2,600
Tanzania	3	--	--	--	--	--	--
Zimbabwe	10	--	--	--	--	--	--
Total	500	3,100	5,900	13,100	12,400	12,400	13,800

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 16

AFRICA: HISTORIC AND PROJECTED TIN METAL PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Nigeria	259	25	25	--	--	--	--
Rwanda	--	--	200	--	--	--	--
Total	260	25	230	--	--	--	--

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 17

AFRICA: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1995-2015[1]

(Metal content in thousand metric tons)

Country[2]	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Algeria	7	10	4	--	106	106	106
Congo (Kinshasha)	5	--	8	18	13	13	13
Morocco	80	103	79	97	98	98	98
Namibia[3]	30	39	69	38	52	52	52
South Africa	70	64	32	29	30	44	44
Tunisia	44	41	16	--	--	--	--
Total	240	260	210	180	300	310	310

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]In addtion to the countries listed, Nigeria also mined a small quantity of zinc.

[3]Does not include zinc content of ore processed at Skorpion solvent extraction-electrowinning facility.

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TABLE 18

AFRICA: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country[2]	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Algeria	30	34	30	30	30	30	30
Namibia	--	--	133	145	150	150	150
South Africa	99	103	102	87	87	87	87
Total	130	140	270	260	270	270	270

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]In addition to the countries listed, Nigeria also refined a small quantity of zinc.

TABLE 19

AFRICA: HISTORIC AND PROJECTED DIAMOND MINE PRODUCTION, 1995-2015[1]

(Thousand carats)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Angola[2, 3]	2,900	4,313	7,079	8,907	9,000	9,000	19,000
Botswana	16,802	24,635	31,890	32,595	28,000	28,000	28,000
Cameroon	NA	NA	12	12	12	12	12
Central African Republic	530	464	383	377	400	400	400
Congo (Brazzaville)	NA	50	--	110	150	150	150
Congo (Kinshasa)	22,024	16,006	35,207	20,947	21,000	21,000	21,000
Côte d'Ivoire	75	320	300	300	300	300	300
Gabon	1	1	(4)	(4)	(4)	(4)	(4)
Ghana	632	878	1,013	643	650	900	900
Guinea	365	327	549	3,098	3,100	3,100	3,100
Lesotho	NA	2	52	450	460	480	480
Liberia	150	170	NA	61	100	100	100
Namibia	1,382	1,552	1,902	2,435	2,400	2,400	2,400
Sierra Leone	214	77	669	371	400	400	400
South Africa	9,683	10,790	15,776	12,901	9,900	10,200	10,500
Tanzania	50	354	220	180	85	540	690
Togo	NA	NA	41	9	10	10	10
Zimbabwe	204	23	251	797	1,000	1,000	1,000
Total	55,000	60,000	95,300	84,200	77,000	78,000	88,000

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Does not include smuggled production.

[3]Production was about 90% gem grade and 10% industrial grade.

[4]Less than 1 unit.

TABLE 20

AFRICA: HISTORIC AND PROJECTED LITHIUM PRODUCTION, 1995-2015

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Zimbabwe	1,000	1,100	1,100	800	800	800	800

[e]Estimated data are rounded to no more than three significant digits.

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TABLE 21

AFRICA: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Botswana	898	947	985	910	950	1,000	1,000
Congo (Kinshasa)	10	--	120	116	120	120	120
Egypt	10	39	300	360	360	360	360
Malawi	15	34	52	60	80	80	80
Morocco	650	31	[2]	--	--	--	--
Mozambique	40	16	3	38	16,300	16,300	16,300
Niger	135	158	182	183	180	180	180
Nigeria	29	12	8	500	500	500	500
South Africa	206,210	224,118	244,940	252,213	281,000	317,000	349,000
Swaziland	172	178	222	175	175	150	150
Tanzania	43	79	31	27	180	3,500	3,500
Zambia	141	168	240	220	200	300	300
Zimbabwe	5,538	3,809	2,891	2,000	2,000	4,000	4,000
Total	214,000	230,000	250,000	257,000	302,000	343,000	375,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Less than 1 unit.

TABLE 22

AFRICA: HISTORIC AND PROJECTED URANIUM PRODUCTION, 1995-2015[1]

[Metal (U) content in metric tons]

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Gabon	653	--	--	--	--	--	--
Malawi	--	--	--	--	1,300	1,400	1,400
Namibia	2,006	2,714	3,147	4,302	9,000	10,700	17,200
Niger	2,970	2,895	3,093	3,032	3,000	8,000	8,000
South Africa	1,443	861	674	554	840	2,200	2,300
Tanzania	--	--	--	--	--	960	960
Total	7,100	6,500	6,900	7,900	14,000	23,000	30,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

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The Mineral Industry of Algeria

By Mowafa Taib

Algeria is the 2d largest country in terms of land area in Africa and the 11th largest country in the world. Its geologic structures include the Tellian chain, the High Plateaus, the Saharan Atlas, the Saharan platform, the Hoggar shield, and the Eglab massif. In 2008, Algeria was a significant producer and exporter of natural gas and accounted for 2.8% of the world's natural gas output. The country held 4.5 trillion cubic meters of natural gas reserves, which was 2.5% of the world's total gas reserves. Algeria was a significant producer and exporter of crude oil; in terms of the volume of its crude oil production, it was ranked third in Africa after Nigeria and Angola and accounted for 2.2% of the world's crude oil output. In addition to hydrocarbons, Algeria produced substantial quantities of metal, including gold, iron ore, silver, and steel; industrial minerals, including barite, bentonite and other clays, cement, crushed stone, gravel, gypsum, helium, marble, nitrogen fertilizer, phosphate, pozzolan, quartz, salt, and sand (BP p.l.c., 2009, p. 8, 22, 24; Mining Journal, 2009; Organization of Arab Petroleum Exporting Countries, 2009, p. 12, 13).

Minerals in the National Economy

The Algerian economy grew in real terms at an annual rate of 2.4% in 2008 compared with a 3.0% growth rate in 2007. The value of hydrocarbon production, which composed 45.5% of the gross domestic product (GDP), increased by 22% in 2008 compared with a 5% increase in 2007. The increase was attributable to a 33% increase in oil prices, which averaged $99.97 per barrel for Algeria in 2008 compared with an average of $74.95 per barrel in 2007. The value added to the economy by the hydrocarbon industry declined for the third consecutive year, registering a decrease of 2.3% in 2008 compared with decreases of 0.9% and 2.5% in 2007 and 2006, respectively. The output of the mining sector, which accounted for 2.7% of the value of the industrial sector, increased by about 10% in 2008 compared with 8% in 2007 and 15% in 2006. The development of sand and stone production to fulfill the increased demand of the construction industry and the expansion in iron ore mining were the main contributors to the growth in the Algerian mining sector in 2008 (Banque d'Algérie, 2009, p. 27-35).

In 2008, total direct investment by international mining companies in Algeria's mining operations was about $69 million, which was 35% more than the $51 million invested in 2007. Sixty-three percent of the international investment in the mining sector was in mineral exploitation; 35%, in mineral exploration; and 2%, in prospecting. The international mining companies that were operating in Algeria in 2008 included Abed Maaden S.p.A., which was a subsidiary of Cecomines of China (lead-zinc); Adwan Chemicals Industries Co. Ltd. of Saudi Arabia (silica sand); Algerian Cement Co., which was acquired by Lafarge S.A. of France from Orascom Industries of Egypt (clays, limestone, and sand); Algerian Concrete Technology, which was a subsidiary of Lafarge (clays, limestone, and sand); ArcelorMittal of Luxembourg (iron ore, limestone, and aggregate); Cancor Mine Inc. of Canada (gold-copper, gold-silver); China Geo Engineering Corp. (gold); Henan Shaolin Hydro Co. Ltd. (copper, gold, manganese, tin, zinc-lead); Poly Sciences and Technology Development Co. Ltd. of China (gold); Soalka-White Federal Cement of Canada and Lebanon (kaolin); and Western Mediterranean Zinc of Australia (zinc-lead) (Ministry of Energy and Mining, 2009, p. 82).

Production

In 2008, Algeria's crude oil production decreased slightly (by 2.6%) and natural gas output increased modestly (by 1.5%) compared with 2007 output levels. The volume of petroleum refinery production increased by about 7% to 195 million barrels (Mbbl) compared with 182 Mbbl in 2007. In 2008, there were notable increases in the production of tuff, by 606%; quartzite, by 287%; gold, by 174%; silver, by 148%; dolomite, by 103%; crushed sand, by 87%; rhyolite, by 78%; aggregates, by 53%; calcite, by 23%; feldspar and gypsum, by about 40% each; lime, by 38%; construction sand, by 19%; methanol, by 11%; cement and salt, by 10% each; and iron ore, by 5%. There were significant decreases, however, in the production of kaolin, by 52%; crude steel, by 49%; pig iron, by 42%; calcite, by 35%; crushed marble, by 26%; coke, by 25%; pozzolan, by 14%; and diatomite, by 12%.

Structure of the Mineral Industry

The Ministère de l'Energie et des Mines (MEM) [Ministry of Energy and Mining] was responsible for regulating the activities of the mining sector through its agencies, which included La Direction Générale des Hydrocarbures [the General Directorate of Hydrocarbons], La Direction Générale des Mines [the General Directorate of Mining], Sonatrach S.p.A., and its subsidiaries and partners. The MEM sought to attract international investors and mining companies to exploit Algerian mineral resources and develop the country's mining industry. The goals of the MEM strategic policies were to meet the national industrial sector's raw material needs, create jobs in regions with low economic activity, and export surplus mining products (Ministry of Energy and Mining, 2008, p. 6).

Mining law No. 01-10 was enacted on July 3, 2001, and created the Agence Nationale du Patrimoine Minier (ANPM) [Algerian Mining Authority] as well as the Agence National de la Géologie et du Contrôle Minier (ANGCM) [National Agency of Geology and Mining Control]. Natural gas and petroleum operations are regulated by Ordinance No. 06-10 of July 29, 2006, that modified and supplemented law No. 05-07 of April 28, 2005, in terms of its relation to hydrocarbons. Environmental laws applicable to the mineral industry include law No. 03-10 of July 19, 2003, and associated decrees, and law No. 05-12 of September 4, 2005. The new mining law affirms

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parity for all investors; separates surface and underground mine tenure; ensures that disputes can be appealed to international arbitrators; gives incentives for importing equipment for mining operations; and provides custom-tax exemption and rebates on extraction royalties for minerals (Mining Journal, 2009, p. 4).

In 2008, the number of employees in the mining sector was 30,267, which was 6.6% more than in 2007. Fifty-eight percent of the mining workforce was employed by privately owned companies and 42% was employed by Government-owned enterprises. Aggregate and stone production companies accounted for 59% of the mining sector workforce followed by clay production companies, 8.9%; phosphate production companies, 6.0%; companies that produced limestone for cement, 4.2%; and iron ore production companies, 3.6% (Ministry of Energy and Mining, 2009, p. 8).

In 2008, 1,143 nonfuel mineral production operations were active in Algeria, of which 77% was privately owned and 23% was state owned. These operations produced 31 minerals and mineral-related material, including aggregate (66%), clays (10%), salt (17%), and natural sand (7%). Large- and medium-sized public-sector enterprises operated barite, bentonite, cement, natural gas, petroleum, and phosphate rock production facilities. The joint ventures of private and state-owned companies dominated the gold production sector [Enterprise d'Exploitation des Mines d'Or S.p.A. (ENOR)], the helium production sector (Helios S.p.A.), and the steel production sector (ArcelorMittal Annaba S.p.A.) (Ministry of Energy and Mining, 2009, p. 12, 63).

In 2008, 84 partnerships were established between international mining companies and Algerian public sector companies. The partnerships included 43 that were set up to explore for copper, gold, lead, limestone, manganese, silver, tin-tungsten, and zinc; 31 that were established to produce iron ore, clays and gypsum for cement, lead-zinc, and sandstone for glass; and 10 that were established to prospect for copper, gold, molybdenum and silver. By the end of 2008, a total of 2,206 licenses had been issued to prospect for, explore for, and (or) exploit 46 mineral commodities. The vast majority of these licenses (93%) were for the production of construction material, such as aggregates (1,307), clays (267), sand (199), gypsum (110), dimension stone (77), tuff (39), sandstone (35), limestone for cement (33), and other construction material (18). The remaining 7% was for production of salt (26), gold (16), lead and zinc (15), barite (14), iron ore (12), copper and feldspar (6 each), calcium carbonate (5), phosphate rock (4), strontium and tungsten (2 each), and other minerals (13) (Ministry of Energy and Mining, 2009, p. 78).

Mineral Trade

In 2008, the value of Algerian exports of goods was $78.59 billion, 98.2% of which was hydrocarbon exports. The value of hydrocarbon exports was $77.2 billion compared with $59.61 billion in 2007, which was an increase of about 30% in value and a decrease of 2% in volume. The value of nonfuel mineral exports decreased to $204 million in 2008 from $302 million in 2007 and $458 million in 2006, or by 32% and 55% compared with that of 2007 and 2006, respectively. Industrial minerals exports accounted for 92% of nonfuel mineral exports, and precious metals exports accounted for 8% of the value of nonfuel mineral exports. The value of base-metals and iron ore exports decreased to zero in 2008 from $148 million and $87 million, respectively, in 2007 (Banque d'Algérie, 2009, p. 63; Ministry of Energy and Mining, 2009, p. 88).

In 2008, the value of crude oil exports accounted for 39.5% of Algeria's total hydrocarbon export value followed by natural gas, 18.8%; condensates, 13.1%; liquefied natural gas (LNG), 11.8%; refined petroleum products, 9.5%; and liquefied petroleum gas (LPG), 7.4% (Banque d'Algérie, 2009, p. 206).

In 2008, the United States received 28% of Algeria's oil exports, or a total of 200.6 Mbbl of crude oil and petroleum products, which was 18% less than the 244.6 Mbbl imported in 2007. Algerian exports accounted for 4% of United States' total crude oil and petroleum products imports in 2008 and 5% in 2007 (U.S. Energy Information Administration, 2009).

Algeria exported 59.4 billion cubic meters of natural gas in 2008, which was slightly more than the 58.7 billion cubic meters exported in 2007. Sixty-three percent of natural gas exports was transported by pipelines to Italy, Portugal, Spain, and Tunisia, and 37% was shipped by tankers to France, Greece, India, Italy, Japan, the Republic of Korea, Spain, Turkey, and the United Kingdom (Organization of Arab Exporting Petroleum Countries, 2009, p. 62).

The value of mining products imports increased in 2008 to $381 million from $321 million in 2007. The 19% increase was attributed to the increase in prices of industrial minerals and to the increase in the volume of mineral imports used for energy production (Banque d'Algérie, 2009, p. 206; Ministry of Energy and Mining, 2009, p. 88).

Commodity Review

Metals

Gold and Silver.—Gold and silver production rebounded in 2008 to the production levels of 2004 and 2005, thus reversing the downward trend in production in 2006 and 2007. In 2008, gold production was 647 kilograms (kg) compared with 236 kg in 2007. Similarly, the output of silver, which was produced as a byproduct of the gold mines, increased to 114 kg in 2008 from 46 kg in 2007. Heap-leach production of gold and silver at the Amesmessa Mine was officially inaugurated in January 2008. Gold and silver were mined by ENOR, which was a partnership company of GMA Resources plc of the United Kingdom (52% interest) and Sonatrach (48%). The company mined the Tirek-Amesmessa site, which is located in the Hoggar region 450 kilometers (km) south of the city of Tamanrasset in southwestern Algeria. Estimates of proven and probable reserves in the 1,417-square-kilometer (km^2) area were 748,000 metric tons (t) of gold ore with a total content of 9.1 t of contained gold (GMA Resources p.l.c., 2009).

Cancor Mines Inc. of Canada acquired two gold exploration licenses in 2008 in addition to the two gold exploration licenses that it had acquired in 2007. The 1,984-km^2 area covered by the four licenses is located in the Hoggar region of the Sahara.

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It included the Terik North (990 km^2), the Tan Chaffao West (446 km^2), the Ouzzal North (258 km^2), and the Tan Chaffao East (200 km^2) properties (Cancor Mines Inc., 2009).

Iron Ore.—Algeria's iron ore production increased by 4.8% in 2008. About 2.1 million metric tons (Mt) of iron ore was produced compared with about 2.0 Mt in 2007, which in turn was a 15% decrease from that of 2006. ArcelorMittal Annaba S.p.A. (a subsidiary of ArcelorMittal) was responsible for about 83% of Algeria's iron ore production at the Boukhadra and the Ouenza Mines. The remaining 17% was produced by Somifer S.p.A at the Djebel Anini Mine in Setif Province, the Khanguet Mine in Tebessa Province, and the Rouina Mine in Ain Defla Province. In 2008, production from the Ouenza Mine in Tebessa Province decreased by 7.6% to about 1.2 Mt from 1.3 Mt in 2007. Iron ore production at the Boukhadra Mine in Tebessa Province increased by 32% to 525,000 t in 2008. Somifer produced 360,000 t of iron ore, which was 22% more than in 2007. The increase was attributed to an increase in output of 75% at the Rouina Mine and about 19% at the Djebel Anini Mine (Ministry of Energy and Mining, 2009, p. 18).

In September 2008, ArcelorMittal reiterated its plan to invest $2.5 billion in Algeria for the establishment of a new steel production complex at the Jijel Province after receiving final approval from the Government. ArcelorMittal planned to increase the steel production capacity of its mills in Algeria to 2.8 million metric tons per year (Mt/yr) and boost iron ore production at the Boukhadra and the Ouenza Mines to 3 Mt/yr within 3 years. Crude steel and pig iron production at the Al-Hadjar Co., which was majority owned by ArcelorMittal (70%), declined by 50% and 42%, respectively, because of a 4-month stoppage in blast furnace and rolling mill production in 2008. Production was expected to return to the previous level by yearend 2009 following the completion of the upgrading of blast furnaces and other related units at the plant (Arab Steel, 2008a, b).

Lead and Zinc.—Western Mediterranean Zinc S.p.A. was established in 2006 as a joint-venture of Terramin Australia Ltd. (65% interest), state-owned Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, S.p.A. (ENOF) (32.5% interest), and Office National de la Recherché Géologique et Minière (ORGM) (2.5%) to develop and evaluate the base-metal resources of the Tala Hamza base-metals deposit at Oued Amizour near the city of Bejaia, which is located in northeastern Algeria. By yearend 2008, Terramin had invested $22.7 million to complete 34,000 meters of diamond core drilling to qualify the project for the feasibility phase. As of October 2008, the total resources (measured, indicated, and inferred) of the Tala Hamza Mine, based on analyses of data from 78 drill holes, were estimated to be 58.6 Mt at grades of 1.3% lead and 5.2% zinc. The Oued Amizour zinc project was designed to include initially a 2-Mt/yr processing plant that would produce 113,000 metric tons per year (t/yr) of zinc in concentrate and 27,000 t/yr of lead in concentrate. The project's design also included an expansion plan that would treat 4 to 5 Mt/yr of ore to achieve annual zinc output of between 400,000 to 500,000 t (Mining Journal, 2009; Terramin Australia Ltd., 2009a, p. 2; 2009b).

Abed Maaden S.p.A., which was a joint venture of Cecomines (90%) and Sonatrach (10%), moved forward with its plan to reopen the Abed lead-zinc mine at Tlemcen Province. Another joint venture of Shaolin Mines of China (51%), Sonatrach (35%), and Goldim (14%) was awarded a lead-zinc exploration license for the Ain Sedjra and the Boukhdema deposits in Setif Province (Ministry of Energy and Mining, 2009, p. 82, 83).

Industrial Minerals

Cement.—In 2008, cement production in Algeria was 17.4 Mt, which was about 10% more than in 2007. Cement production had been on the rise since 2001 to meet the increased local demand that was estimated to be 21 Mt/yr. The 2008 production level represented an 85% increase compared with the 9.4 Mt produced in 2001. There were 14 cement plants in Algeria; all were located in the northern part of the country. Twelve of these plants were state-owned and were responsible for 66% of the national production, whereas the two privately owned plants produced the remaining 34%. Cement production from the state-owned plants decreased by 1.2% in 2008 compared with 2007, whereas production by private sector plants increased by 31% during the same period. The private companies included Algerian Cement Co. and Ciment Blanc d'Algérie S.p.A. Both companies became subsidiaries of Lafarge following Lafarge's acquisition of Orascom Construction Industries S.A. of Egypt in January 2008. Algerian Cement Co. operated the Burdj Bouredj plant in M'Sila Province, which was located 240 km southeast of Algiers and produced about 5.6 Mt of portland cement in 2008. Ciment Blanc d'Algérie, which began white cement production at the Oggaz near Oran in Mascara Province in 2007, produced about 330,000 t of white cement in 2008. The combined capacity of Lafarge's two plants was 7.5 Mt/yr of cement, including 0.5 Mt/yr of white cement (Ministry of Energy and Mining, 2009, p. 54).

In June 2008, Lafarge was awarded a 10-year management contract and a 35% equity share in the Meftah cement plant, which was located near Algiers, in return for investing $68 million to increase the plant's production capacity to 1.1 Mt/yr from 0.8 Mt/yr by 2010. The Maftah cement plant was one of the state-owned plants operated by Société des Ciments de la Mitidja Entreprise des Ciments et Dérivés du Centre (Lafarge S.A., 2008).

Phosphate Rock.—Phosphate rock was produced by Société des Mines de Phosphate (Somiphos) at Djebel Onk in Bir El Ater, which is located in southeastern Tebessa Province. Somiphos was an affiliate of Enterprise Nationale de Fer et du Phosphate (Ferphos). The volume of phosphate rock produced in 2008, which was 1.8 Mt, was a slight increase compared with that of 2007. Production of phosphate rock had been on an upward trend in recent years. The current (2008) production level was about 106% more than the 880,000 t of phosphate rock produced in 2000. The short-term plans of Ferphos aimed to double the company's current capacity of 2 Mt/yr by 2010. A long-term production target of 30 Mt of phosphate rock annually by the year 2030 had been announced based on the large phosphate rock reserves, which were estimated to be more than 2 billion metric tons. To achieve these goals, two additional phosphate treatment facilities were planned near the Djebel Onk Mine at Jijel and Mdarouche. The Government announced

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a plan to build a new phosphate processing plant in Guelma Province at Bouchegouf, which is located 450 km southeast of Algiers. A joint venture of Engro Chemical of Pakistan (49% interest), Ferphos (26%), and Sonatrach (25%) was established in 2008 to manage the Bouchegouf plant (Industriel d'Engrais Phosphatés de Bouchegouf). The plant was designed to produce 1.6 Mt/yr of sulfuric acid, 1 Mt/yr of diammonium phosphate (DAP), and 0.5 Mt/yr of phosphoric acid. Another fertilizer manufacturing project was planned at Babel-Assa in Tlemcen Province. The plant was expected to produce 300,000 t/yr of phosphate fertilizers. The shareholders of the Babel-Assa fertilizer project were Getax Australia Pty Ltd. (49% interest), Ferphos (29%), and Sonatrach (22%) (ANIMA Investment Network, 2008; Mining Journal, 2009).

Mineral Fuels

Natural Gas.—Construction work for the Algerian-European pipeline Medgaz, which began in July 2007, continued throughout 2008, including building the deepwater pipeline in March and completing it in December of the same year. The project aimed to transport natural gas from Hassi R'Mel in Algeria to the reception terminal at Almeria's El Perdigal beach in Spain by way of the Saharan Atlas Mountains through Beni Saf and under the Mediterranean Sea. The 60-centimeter (cm)-diameter, 210-km pipeline would have an initial capacity to transport 8 billion cubic meters per year of natural gas, and the first gas was expected to arrive at Almeria, Spain, in 2010. The project's shareholders included Sonatrach (36%), Compania Espanola de Petroleos S.A. and Iberdrola S.A. (20% each), and Endesa S.A. and GDF Suez (12% each) (Medgaz S.A., 2009).

Petroleum.—In July 2008, Agence Nationale pour la Valorisation des Ressources en Hydrocarbures (ALNAFT) [National Agency for Hydrocarbon Resources Valuation] launched the seventh round licensing bid for the exploration and exploitation of hydrocarbons in 45 blocks. The blocks covered a 142,257-km^2 area across 16 zones that were spread throughout the country's sedimentary basins. This bidding call was the first licensing round under the new hydrocarbon law (law No. 05-07 of April 28, 2005), which granted Sonatrach at least a 51% ownership share of every contract given to a foreign company. It was also the first round to be managed by ALNAFT, which was established by the new hydrocarbon law. The bidding results, which were announced on December 13, 2008, awarded Eni Algeria Ltd. of Italy a 49% stake in the Kerzaz license, which has an area of 16,000 km^2 and is located in the Timimoun basin 400 km southeast of the Hassi R'Mel field. BG Group of the United Kingdom received a 49% interest in the Guern El Guessa concession, which is located northwest of the Hassi Ba Hamou Perimeter. E.ON Ruhrgas A.G. of Germany was awarded the Rhourde Yacoub exploration permit; and Gazprom Group of Russia won the El-Assel permit in the Berkine basin located near Algeria's border with Tunisia (Deloitte Petroleum Services, 2008).

The Government planned to increase the country's petroleum refining capacity to 50 Mt/yr by 2014 from the current (2008) 22 Mt/yr. A fourth refinery was planned at Tairet, which is located 300 km southwest of Algiers. The new refinery would have a production capacity of 300,000 barrels per day and was expected to commence production in 2014. Naftec S.p.A., which was a subsidiary of Sonatrach, announced that it was allocating $4 billion to upgrade Algeria's existing oil refineries at Arzew, Hassi Messoud, and Skikda (Organization of Arab Petroleum Exporting Countries, 2009, p. 31).

Outlook

The Algerian economy depends heavily on natural gas and petroleum exports. Thus, lower prices and reduced production volume can significantly weaken the country's economic growth and development. In addition to sustaining hydrocarbon production, the Government sought to diversify the economy by tapping into Algeria's vast mineral resources through joint ventures with international mining companies to explore and exploit the country's mineral reserves of metals, such as copper, gold, lead, iron ore, silver, and zinc, and industrial minerals, such as cement and phosphate rock. The Government plans to invest more than $150 billion by 2013 to create 3 million jobs and build 1 million housing units. Demand for building and construction materials and for metals, such as steel, which are used in the extensive networks of gas and crude oil pipelines and petrochemical plants currently under construction or in planning phase, is expected to increase considerably.

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TABLE 1
ALGERIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2, 3]		2004	2005	2006	2007	2008
METALS						
Gold metal	kilograms	593	637	377	236	647
Iron and steel:						
Iron ore, gross weight		1,554	1,579	2,340	1,982	2,077
Metal:						
Pig iron		994	952	1,093	1,193	690
Steel, crude		1,014	1,007	1,158	1,278	646
Lead, metal, refined[e]		5	5	5	--	--
Mercury	kilograms	73,451	276	--	--	--
Silver metal	do.	40	110	63	46	114
Zinc:						
Concentrate, Zn content	metric tons	231	4,463	572	--	--
Metal, smelter output[e]		25	30	30	30	30
INDUSTRIAL MINERALS						
Barite, crude		48	53	65	63	60
Cement, hydraulic		11,000	12,800	14,702	15,886	17,397
Calcite		190	193	191	206 r	254
Clays:						
Bentonite		46	53	27	33	31
Common		6,118	7,383	7,308	9,529	10,973
Dolomite (industrial)		4	5	8	1	2
Fuller's earth		2	1	20	30	23
Kaolin		24	34	33	107	51
Diatomite	metric tons	2,665	1,814	1,800	1,902	1,668
Feldspar		24	34	66	83	116
Gypsum[4]		460	635	1,033	1,198	1,672
Lime, hydraulic		163 e	32 r	28 r	46 r	64 r
Nitrogen, N content of ammonia		543	550	470	500	500
Phosphate rock:						
Gross weight		820	878	1,510	1,800	1,805
P_2O_5 content[e]		300	260	450	536	542
Pozzolan		508	494	433	570	491
Salt, brine and sea salt		176	197	260	183	202
Sand and gravel:						
Construction sand	thousand cubic meters	1,366	1,599	2,143	2,553	3,044
Silica sand		180	203	48 r	519 r	498
Granulates:						
Aggregates, crushed stone, and gravel	thousand cubic meters	17,020 r	19,050 r	21,220	27,230 r	41,604
Crushed sand	cubic meters	1,800 r	2,210 r	3,380 r	5,590	10,470
Stone:						
Aragonite	do.	NA	1,400	NA r	206 r	254
Quartzite		NA	13	6	35	136
Marble:						
Blocks	thousand cubic meters	22	22	16	11	11
Crushed		121	154	148	170	126
Miscellaneous types of dressed stone	thousand cubic meters	2	5	4	12	10
Rhyolite	cubic meters	NA	2,960	3,200	3,430	6,100
Tuff	thousand cubic meters	791	755	951	1,729	12,209
Sulfur, S content of sulfuric acid[e]		22 r	22	22	22	22

See footnotes at end of table.

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TABLE 1—Continued
ALGERIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2, 3]		2004	2005	2006	2007	2008
MINERAL FUELS AND RELATED MATERIALS						
Coke		439	398	423	419	315
Gas, natural:						
Gross	million cubic meters	183,800 r	193,000 r	194,800 r	198,200 r	201,000
Dry[5]	do.	82,500 r	88,200 r	84,500 r	84,800 r	86,500
Helium, liquid	do.	17	17	15	20	20
Methanol	do.	107	94	130	118	130
Natural gas plant liquids	thousand 42-gallon barrels	361,000	416,000	409,000	423,000	442,000
Petroleum:[e]						
Crude, including condensate	do.	590,000 r	612,000 r	614,000 r	616,000 r	600,000
Refinery products:						
Liquefied petroleum gas	do.	7,000	6,000	6,000	6,000	6,000
Gasoline	do.	17,000	17,000	19,000	17,000	22,000
Naphtha	do.	25,000	26,000	26,000	28,000	27,000
Kerosene and jet fuel	do.	8,000	8,000	8,000	8,000	7,000
Distillate fuel oil	do.	42,000	44,000	49,000	49,000	53,000
Lubricants	do.	1,000	1,000	1,000	1,000	1,000
Residual fuel oil	do.	36,000	34,000	36,000	37,000	40,000
Other	do.	2,000	37,000	34,000	36,000	39,000
Total	do.	138,000	173,000	179,000	182,000	195,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available. -- Zero.
[1]Table includes data available through December 31, 2009.
[2]In addition to the commodities listed, secondary aluminum, secondary lead, and secondary copper may be produced in small quantities; crude construction materials for local consumption, and fertilizer, perlite, and urea are produced, but available information is inadequate to make estimates of output.
[3]In addition to the commodities listed, about 700 metric tons per year (t/yr) of caustic soda is estimated to have been produced.
[4]Includes about 50,000 t/yr of plaster.
[5]Excludes gas used in flaring, reinjection, transmission losses, and venting.

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TABLE 2
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia	Le groupe Asmidal	Alzofert plant, Arzew	660,000
Do.	do.	Fertial plant, Annaba	330,000
Barite	Société des Mines de Baryte d'Algérie (SOMIBAR) S.p.A. [Entreprise Nationale es Produits Miniers Non Ferreux et des Substances Utiles, S.p.A (ENOF)]	Mizab	35,000
Do.	do.	Boucaid	20,000
Do.	Société des Baryte (SOBAR SARL)	Chaabet Abou Fares	7,000
Bentonite	Bentonites Company of Algeria (BENTAL), [a subsidiary of Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, S.p.A. (ENOF)]	Hammam Boughrara	18,000
Do.	do.	M'Sila	15,000
Cement:			
Portland	Algerian Cement Co. (ACC) (Lafarge S.A., 100%)	do.	5,000,000
Do.	Ciment Blanc d'Algerie S.p.A. (Lafarge S.A., 100%)	Oggaz, Mascara Province	2,500,000
Do.	Entreprise des Ciments et Dérivés d'Ech—Cheliff	Chlef	2,000,000
Do.	Société des Ciments de la Mitidja (Entreprise des Ciments et Dérivés du Centre, 65%, and Lafarge S.A, 35%)	Meftah	800,000
Do.	Société des Ciments de Sour El Ghozlane (Entreprise des Ciments et Dérivés du Centre)	Sour El Ghozlane	1,000,000
Do.	Société des Ciments Zahana (Entreprise des Ciments et Dérivés de l'Ouest)	Zahana	1,200,000
Do.	Société des Ciments Beni Saf (Entreprise des Ciments et Dérivés de l'Ouest)	Beni Saf	1,000,000
Do.	Société des Ciments Saïda (Entreprise des Ciments et Dérivés de l'Ouest)	Hassasna	500,000
Do.	Société des Ciments d'Aïn-Touta (Entreprise des Ciments et Dérivés de l'Est)	Ain Touta	1,000,000
Do.	Société des Ciments d'Aïn-Kébira (Entreprise des Ciments et Dérivés de l'Est)	Ain-Kebira	1,000,000
Do.	Société des Ciments de Hamma-Bouziane (Entreprise des Ciments et Dérivés de l'Est)	Hamma-Bouziane	1,000,000
Do.	Société des Ciments de Hadjar Soud (Entreprise des Ciments et Dérivés de l'Est)	Bekkouche	900,000
Do.	Tabessa Cement Company S.p.A.	Tebessa	525,000
Do.	Société des Ciments de l'Algérois (Entreprise des Ciments et Dérivés du Centre)	Rais-Hamidou	368,000
White cement	Ciment Blanc d'Algerie S.p.A. (Lafarge S.A., 100%)	Oggaz, Mascara Province	550,000
Coke	ArcelorMittal Annaba S.p.A. (ArcelorMittal, 70%, and Groupe Industriel Sider, 30%)	El Hadjar	1,200,000
Copper, cathode	Société Algérienne du Zinc (Entreprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, S.p.A., 100%)	Ghazaouet	NA
Diatomite	Diatoms Company of Algeria S.p. A [Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, S.p.A. [ENOF)]	Tahalait Quarry, Sig	2,000
Dolomite	Algerian Agreggates S.p.A. (ALGRAN)	Djebel Taioualet	8,000
Feldspar	Tufeal SARL	Bouaita	83,000
Fertilizers:			
Nitrogenous:			
Ammonium nitrate	Le Groupe Asmidal	Alzofert plant, Arzew	495,000
Do.	do.	Fertial plant, Annaba	330,000
Do.	do.	do.	240,000
Do.	Fertalge Industries S.p.A.	Arzew	360,000
Phosphatic[1]	do.	Fertial plant, Annaba	800,000
Gold, content of mine output	Entreprise d'Exploitation des Mines d'Or S.p.A. (ENOR) (GMA Resources p.l.c., 52%, and Sonatrach S.p.A., 48%)	Tirek Mine	3
Do.	do.	Amesmessa Mine	3 [1]
Gypsum	32 private sector units and 13 public sector units	Oran, O. El Bouaghi, Chlef, Ghardaia Biskra, Mascara, Bouira, M'silla, Medbea Batn, Setif, Bejaia, Milla, Tiaret	1,700,000
Helium million cubic meters	Helios S.p.A. (Sonatrach Valorisation Hydrocarbonés, 51%, and Helap S.p.A., 49%)	GI2Z complex, Arzew	17
Do. do.	Helison Production S.p.A. (Linde AG, 50%, and Sonatrach S.p.A., 50%)	GL1K complex. Skikda	17

See footnotes at end of table.

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TABLE 2—Continued
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron ore		ArcelorMittal Annaba S.p.A.	Ouenza Mine	1,200,000
Do.		do.	Boukhadra Mine	525,000
Do.		Société des Mines de Fer d'Algérie S.p.A. (SOMIFER) SOMIFER S.p.A.	Khanguet Mine	50,000
Do.		do.	Anini Mine	170,000
Do.		do.	Rouina Mine	140,000
Kaolin		Société des Kaolins d'Algérie (SOALKA) S.p.A.	Tamazert, El Milia	20,000
Do.		SARL Faïenceries Algériennes	Adjarda, Chekfa	95,000
Lime		SODEPAC (ERCO Group)	Hassasna	93,000
Do.		Société de Chaux de l'Ouest	Oran	65,000
Do.		Unité Chaux de Chettaba (Société des Produits Dérivés de l'Est, 100%)	Chettaba	11,000
Limestone		Mittal Steel Annaba SPA	Oued N'hal	250,000
Marble:				
Blocks	cubic meters	Entreprise Nationale du Marbre S.p.A.	Oran and Skikda Province	10,460
Do.	do.	SMS Bouhouita SARL	Skikda Province	160
Crushed		Commercialisation du Marbre et de Dérivés de Marbre S.p.A. and Entreprise Nationale du Marbre S.p.A.	Chlef, Oran, Skikda, Tizi Ouzou, and Tlemcen Provinces	17,000
Methanol		Société Nationale de Pétrochimie S.p.A. (Sonatrach S.p.A 100% owned subsidiary, through Holding Raffinage et Chimie des Hydrocarbures)	Methanol plant, Arzew	113,000
Natural gas:				
Crude	million cubic meters	Sonatrach S.p.A.	Numerous gasfields, including Adrar, Hamra, Hassi R'Mel, and Sbaa	12,000
Do.	do.	do.	Numerous gasfields	33,000
Liquefied	do.	do.	GL2Z complex, Bethioua	18,000 [2]
Do.	do.	do.	GL1Z complex, Bethioua	16,000 [2]
Do.	do.	do.	GL1K complex, Skikda	6,000 [2]
Do.	do.	do.	GL4Z complex, Arzew	2,000 [2]
Petroleum:				
Crude	42-gallon barrels per day	do.	About 50 oilfields, including Acheb West, Amassak/Tin-Yaguene, Draa Tamra, Edjeleh, El Borma, El Gassi, Gassi-Touil East, Guellala, Hassi Messaoud North and South, Ohanet North, Rhourde El Baguel, Tin-Fouye, and Zarzaitine	1,700,000
Refined	do.	Société Nationale de Raffinage de Pétrole-NAFTEC S.p.A.	RA1K refinery, Skikda	320,000
Do.	do.	do.	RA1G refinery, Algiers	58,000
Do.	do.	do.	RA1Z refinery, Arzew	70,000
Do.	do.	do.	RHM refinery, Hassi-Messaoud	30,000
Phosphate rock		Société des Mines de Phosphates S.p.A. (SOMIPHOS) (a subsidiary of FERPHOS Group S.p.A)	Djebel Onk (Djemidjema and Kef Essenoun)	2,000,000
Pozzolan		Pozzolan Society and Building Materials SPMC)	Rockbet El Hassi	452,000
Do.		Société des Ciments Béni Saf (ERCO group)	Beni Saf	11,000
Do.		Entreprise Nationale du Fer et du Phosphate	do.	600,000
Salt, crude:				
Rock		Enterprise Nationale d'Exploitation des Carrières de Sels Industriels et Domestiques et Commercialisation des Sels S.p.A. (ENASEL)	El Outaya, Biskra	100,000
Solar		Several private companies	Bethioua, Oran; El Meghaier, El Oued, Guergour Lamri, Setif Ouled Zouai, Oum el Bouaghi, and Sidi Bouziane, Relizane	100,000
Steel:				
Crude		ArcelorMittal Annaba S.p.A. (ArcelorMittal, 70%, and and Groupe Industriel Sider, 30%)	Blast furnaces at El Hadjar, Annaba	2,100,000
Do.		do.	Electric arc furnace at El Hadjar, Annaba	400,000

See footnotes at end of table.

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TABLE 2—Continued
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Steel—Continued:				
Processed		ArcelorMittal Annaba S.p.A. (ArcelorMittal, 70%, and and Groupe Industriel Sider, 30%)	Hot-strip mill at El Hadjar, Annaba	1,800,000
Do.		do.	Cold-rolling mill at El Hadjar, Annaba	1,050,000
Do.		do.	Bar and wire rod mills at El Hadjar, Annaba	850,000
Do.		do.	Seamless tube mill at El Hadjar, Annaba	700,000
Do.		Entreprise Nationale de Tubes et de Transformation de Produits Plats (Groupe Industriel Sider, 100%)	Welded tube plant at Ghardaia	128,000
Do.		Société Algérienne de Fabrication Tubes en Spirale (Groupe Industriel Sider, 100%)	Welded tube plant at El Hadjar, Annaba	70,000
Stone		L'Algérienne des Granulats S.p.A. [Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, (ENOF) S.p.A.]	Aggregate quarries at Adrad Oufarnou, Arzew, Ghedir, Gustar, Keddara, Oued Fodda, Teioueit, and Timezrit	3,000,000
Do.		Société des Diatomites d'Algérie S.p.A. [Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, S.p.A. (ENOF)]	Oggaz limestone quarry, near Sig	12,500
Do.		Société des Bentonites d'Algérie S.p.A. [Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, S.p.A. (ENOF)]	Limestone quarries near Beni Saf and M'Said	12,000
Sulfuric acid		Société Algérienne du Zinc (Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	70,000
Tuff	cubic meters	CTIC-CRCC Group (China)	Annaba, Boumerdes, Sidi Bel Abbes Mustganem, Mascara, Oran, Relizane	10,300,000
Do.		6 public sector units and 59 private units	Ain Temouhent, Tipaza, Tiaret	2,000,000
Urea		Fertalge Industries S.p.A.	Arzew	400,000

Do., do. Ditto. NA Not available.

[1]Capacity includes 500,000 to 600,000 metric tons per year (t/yr) of compound fertilizer [nitrogen, phosphorus, and potassium (NPK), or phosphorus and potassium (PK)], or triple superphosphate (TSP), and 240,000 t/yr of single superphosphate (SSP).

[2]One cubic meter of liquefied natural gas is equivalent to 584 cubic meters of natural gas. Natural-gas-equivalent capacities (in billions of cubic meters) were GL2—10.3, GL1Z—10.2, GL1K—4, and GL3Z—1.1.

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The Mineral Industry of Angola

By Omayra Bermúdez-Lugo

Angola's mineral industry was dominated by diamond and petroleum production; petroleum however, was by far the major driving force of the economy, accounting for about 83% of the gross domestic product (GDP), 95% of exports, and 83% of Government revenues in 2008. The country ranked third among the world's leading producers of crude petroleum; it ranked seventh among the world's leading producers of rough diamond by volume and fifth in terms of value. Other mineral commodities produced in the country included cement, granite, marble, and salt. Undeveloped mineral resources included copper, gold, gypsum, iron ore, lead, lignite, manganese, mica, nickel, peat, phosphate rock, silver, and zinc (BP p.l.c., 2009, p. 8; Kimberley Process Certification Scheme, 2009; U.S. Department of State, 2009).

Production

Crude petroleum production increased by about 9% to reach 684 million barrels in 2008 compared with about 629 million barrels in 2007; diamond production decreased by 8.2% to 8.9 million carats; and production of hydraulic cement increased by 27% to about 1.8 million metric tons (Mt). Data on mineral production are in table 1.

Structure of the Mineral Industry

The Ministerio da Geologia e Minas is the Government entity responsible for the negotiation of mineral rights contracts, for enforcing mining laws, and for executing the Government's policy regarding geologic and mining activities. It is also the entity responsible for coordinating efforts regarding Kimberley Process Certification Scheme (KP) compliance. All mineral rights in Angola belong to the state, and all mining and prospecting contracts must be approved by the Conselho de Ministros [Council of Ministers]. The Corpo Especial de Fiscalização y Segurança de Diamantes (CSD) is the Government entity responsible for ensuring the security of Angola's diamonds as they travel to the capital city of Luanda for export from the respective mining operations and buying houses located throughout the country. The CSD reports directly to the President through the Chefe do Serviço de Informações [Chief of Information Services]. The CSD has administrative, financial, and operational autonomy but works closely with the National Police and Customs. Empresa Nacional de Diamantes de Angola E.P. (Endiama), which is the Government-owned diamond company, is responsible for creating partnerships with international companies prospecting for diamond and is a partner in all diamond ventures. Endiama's subsidiaries include Sociedade de Comercialização de Diamantes de Angola (Sodiam), which is in charge of the marketing, sale, and trade of all diamond produced in Angola and the entity responsible for KP compliance; and Endiama Prospeção e Produção S.A.R.L., which oversees all Endiama's mining and prospecting interests. Sociedade Nacional de Combustíveis de Angola (Sonangol) is the Government-owned company responsible for petroleum exploration and production.

Mineral Trade

U.S. exports to sub-Saharan Africa totaled $18 billion in 2008, or about 1.7% of U.S. total world exports of $1,070 billion. U.S. imports from sub-Saharan Africa totaled $86.1 billion for the same period, or about 4.1% of U.S. total imports from the world. About 22% of all U.S. imports from sub-Saharan Africa came from Angola, and about 12% of all U.S. exports to sub-Saharan Africa went to Angola. Angola's exports to the United States were valued at about $18.9 billion in 2008 compared with about $12.5 billion in 2007. Crude petroleum accounted for about $18.5 billion of these exports; fuel oil, about $325 million; and gem-quality diamond, about $34 million. Imports from the United States were valued at about $2.0 billion in 2008 compared with a revised $1.2 billion in 2007; these included nearly $645 million in drilling and oilfield equipment and about $23.9 million in excavating machinery (Jones, 2009, p. 6; U.S. Census Bureau, 2009a, b).

Commodity Review

Metals

Copper.—In May, Hansa Resources Ltd. of Canada signed a memorandum of understanding with Angola Petroleum Services S.A.R.L. to acquire a 70% interest in the Mavoio-Tetelo-Bembe exploration project. The project, which is located in the Uige Province near the border with the Democratic Republic of the Congo [Congo (Kinshasa)], included the exploration rights to the historic Mavoio copper mine and to the Bembe and the Tetelo copper deposits. The Mavoio Mine operated from 1937 to 1961 as both an open pit and an underground mine. Hansa estimated that the Tetelo prospect contained resources ranging between 6.2 Mt at a grade of 3.1% copper and 12.8 Mt at a grade of 3.9% copper based on historic drilling conducted during the 1940s and 1970s. Other mineral occurrences within the property reportedly included cobalt, gold, lead, manganese, silver, vanadium, and zinc (Hansa Resources Ltd., 2008).

Industrial Minerals

Cement.—In Angola, cement was produced by two companies, Companhia de Cimento do Lobito S.A. (Secil-Lobito) and Nova Cimangola S.A. (Cimangola). The Cimangola cement plant, which is located in the city of Luanda, had an annual production capacity of 1.5 million metric tons per year (Mt/yr) of cement and 540,000 metric tons per year (t/yr) of clinker. The Angolan Government held an 89% interest in Cimangola. The Secil-Lobito plant, which is located in the

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city of Lobito, Benguela Province, had an annual production capacity of 250,000 metric tons (t) of cement and was owned by TecnoSecil Investimentos e Participações SARL of Portugal (TecnoSecil) (51%) and the Government (49%). Plans were underway to increase the production capacity at Secil-Lobito by 120,000 t/yr to 370,000 t/yr (Portal das Empresas do Governo de Angola, 2008b).

A consortium of international companies, which included Acurias of France, Dubai-based ETA Star Property Developers LLC, FLSmidth A/S of Denmark, Sjitz Corp. of Japan, and Wartsila Corp. of Finland, planned to invest $500 million in the construction of a new cement plant in the Cuara district, Cuanza Sul Province. The plant, which would have a production capacity of 1.4 Mt/yr, was expected to be completed by 2011 and to generate more than 4,000 jobs. Once completed, the plant was expected to supply about 25% of the country's domestic requirements for cement (Noticias lusofonas, 2008; Suga, 2008).

ESCOM S.A of Portugal in joint venture with Camargo Correa Cimentos of Brazil signed a memorandum of understanding with Gema Group of Angola to build a new cement plant in Benguela Province at a cost of $200 million. The joint venture of ESCOM and Camargo Correa would hold a 60% interest in the project and Gema Group would hold the remaining 40%. The cement plant, which was to be named Palanca Cimentos S.A., was expected to be completed by 2011 and to produce 600,000 t during its first year of operation; 800,000 t during the second year; and 1.2 Mt/yr during the third year when it was expected to reach nameplate capacity (ESCOM S.A., 2008; Noticias lusofonas, 2008).

Diamond.—Angola has vast diamond resources available for prospecting and for economic development. Alluvial and eluvial diamond deposits occur in the Provinces of Bie, Cunene, Cuando Cubango, Cuanza Sul, Huambo, Huila, Lunda Norte, Lunda Sul, Malanje, Moxico, and Uige. In the northern Provinces, diamond deposits extend into Congo (Kinshasa). About 700 kimberlite pipes containing reserves of about 50 million carats were known to exist in the country. Other deposits were thought to occur in coastal areas and offshore. In 2008, industrial-scale diamond operations accounted for about 92% of the country's total diamond production by volume and for about 82% of total diamond production by value (Mr. Paulo Mvika, National Director of Mines, Ministry of Geology and Mines of Angola, written commun., August 24, 2009).

Gypsum.—Angola planned to begin producing 6,000 metric tons per month of gypsum from a pilot plant that was located in Alto Chingo within the city of Sumbe in Cuanza Sul Province. The plant, known as Fábrica de Gesso do Sumbe, would produce crushed gypsum for the agricultural and cement industries and calcined gypsum for the construction industry (Portal das Empresas do Governo de Angola, 2008a).

Mineral Fuels

Petroleum.—Angola was a member of the Organization of the Petroleum Exporting Countries. Petroleum was produced offshore the enclave of Cabinda, offshore in the Cuanza Basin north of the city of Luanda, offshore the country's northern coast, and onshore near the city of Soyo. Most of the premier international oil companies had acquired petroleum interests in Angola, including American companies Anadarko Petroleum Corp., Chevron Corp., ConocoPhillips, Exxon Mobil Corp., and Marathon Oil Corp.; Petróleo Brasileiro S.A. (Petrobras) of Brazil; Total of France; Eni SpA of Italy; Royal Dutch Shell plc of the Netherlands; Statoil ASA of Norway; and BP p.l.c. and Tullow Oil plc. of the United Kingdom. In 2008, Angola produced about 1.875 million barrels per day (Mbbl/d) of crude petroleum compared with about 1.72 Mbbl/d in 2007 and 1.421 Mbbl/d in 2006. Angola's petroleum production in 2008 placed the country as Africa's third ranked producer after Nigeria and Algeria, displacing Libya from its traditional third spot as one of Africa's leading producers in terms of barrels (BP p.l.c., 2009, p. 8; Petroleum Economist, 2008).

In September, Sonangol acquired a 35% interest in São Tome e Principe's Empresa Nacional de Combustíveis e Oleo (ENCO). With the purchase, Sonangol increased its stake in ENCO to 75%; the São Tomean Government held 16%, and private investors held the remaining 9% (Agencia de Noticias de Portugal S.A., 2008).

Marathon planned to sell two-thirds of its 30% interest in offshore Block 32 for about $2 billion. Petroleum resources at Block 32 were estimated to be 1.5 billion barrels of oil equivalent. Among those companies interested in the project were China National Offshore Oil Corp. and China Petrochemical Corp., which planned to bid jointly for the block; Oil and Natural Gas Corp. of India; and Petrobras. The remaining partners in the block were Total (30%), Sonangol (20%) ExxonMobil (15%), and Petrogal S.A. (5%) (Miles, 2008; Zang, 2008).

Angola had one petroleum refinery, which produced about 40,000 barrels per day (bbl/d). In December, Sonangol awarded the contract for the construction of the new Lobito refinery to Texas-based KBR Inc. Under the terms of the contract, KBR was to provide the engineering, procurement, and construction management services for the development of the 200,000-bbl/d-capacity refinery. The contract included the development of a road to transport material and equipment to the refinery, as well as port facilities to import crude oil and export hydrocarbon products. The refinery was expected to be in operation by 2013 (International Business News, 2008; KBR Inc., 2008).

Outlook

Despite the global financial crisis in 2008, Angola ranked second in terms of its GDP growth (13.2%) among the world's fastest growing economies in 2008 after Qatar (16.4% GDP growth). Although the International Monetary Fund projects a slowdown in GDP growth for 2009 compared with that of 2008, it estimates that Angola will rank fourth among the world's fastest growing economies in 2010, reaching an estimated 9.3% GDP growth rate (International Monetary Fund, 2009). Government revenues are likely to continue to be led by the diamond and oil sectors. Foreign direct investment in the mineral sector as well as in mineral prospecting are likely to increase in the short run owing to the country's favorable political climate following the first democratic elections

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in 16 years in September 2008. The country's dilapidated infrastructure may in the short run present challenges to investors; however, plans to increase capacity at the country's existing cement plants and plans to build additional cement production capacity may in the long run offset the country's challenges in obtaining construction materials to jump start infrastructure projects, including port facilities, roads, and buildings.

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TABLE 1

ANGOLA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS						
Cement:						
Hydraulic	thousand metric tons	740	1,315 [3]	1,373 [3]	1,400	1,780
Clinker	do.	480	500	500	500	500
Diamond[4, 5]	thousand carats	6,146 [3]	7,079 [3]	9,175 [3]	9,702 [3]	8,907 [3]
Granite	cubic meters	15,000	15,000	35,000 [3]	46,000 [3]	50,000
Marble	do.	100	100	100	100	100
Salt	metric tons	30,000	30,000	35,000 [3]	35,000	35,000
MINERAL FUELS AND RELATED MATERIALS						
Petroleum:						
Crude	thousand 42-gallon barrels	383,250 [3]	456,250 [3]	513,560 [r, 3]	628,900 [r, 3]	684,375 [3]
Refinery products[6]	do.	14,000	14,000	12,600	13,000	13,000

[r]Revised. do. Ditto.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through October 8, 2009.

[3]Reported figure.

[4]Production was approximately 90% gem quality and 10% industrial grade.

[5]Kimberley Process Certification Scheme.

[6]Includes asphalt and bitumen.

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TABLE 2
ANGOLA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Nova Cimangola S.A. (Government, 89%, and private investors, 11%)	Luanda	1,500,000; 540,000 clinker.
Do.		Companhia de Cimento do Lobito S.A. (TecnoSecil Investimentos e Participações SARL, 51%, and Government, 49%)	Lobito, Benguela Province	250,000.
Diamond	thousand carats	Sociedade Mineira de Catoca Lda. [Empresa Nacional de Diamantes de Angola E.P. (Endiama), 32.8%; ALROSA S.A., 32.8%; Daumonty Financing Company B.V., 18%; Odebrecht Mining Services Inc., 16.4%]	Catoca Mine, 36 kilometers south of Saurimo, Lunda Sul Province	6,500.
Do.	do.	Empresa Nacional de Diamantes de Angola E.P. (Endiama), 51%; New Millenium Resources Ltd., 34%; Mombo Lda., 15%	Rio Lapi Mine, 45 kilometers northeast of Saurimo, Lunda Sul Province	240.
Do.	do.	Trans Hex Group Ltd., 35%, and Empresa Nacional de Diamantes de Angola E.P. (Endiama), 40%	Fucauma Mine, northeastern Angola	120.
Do.	do.	Trans Hex Group Ltd., 32%, and Empresa Nacional de Diamantes de Angola E.P. (Endiama), 40%	Luarica Mine, northeastern Angola	90.
Do.	do.	Sociedade de Desenvolvimento Mineiro de Angola S.A.R.L. (Empresa Nacional de Diamantes de Angola E.P. (Endiama), 50%, and Odebrecht Mining Services Inc., 50%)	Luzamba alluvial mine, Cuango Valley	70.
Petroleum refinery products	thousand 42-gallon barrels	Fina Petróleos de Angola (Total S.A., 64.1%, and Government, 34%)	Refinery, Luanda	14,600.
Steel		Chung Fong Holding Co., 51%, and Government, 49%	Relaunching of steel plant (under development)	36,500.
Do.		Grupo Ferpinta of Portugal	Two pipe mills at Viana, 30 kilometers east of Luanda	6,000

Do., do. Ditto.

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The Mineral Industries of Benin, Burkina Faso, and Sao Tome e Principe

By Omayra Bermúdez-Lugo

BENIN

Mining did not play a significant role in Benin's economy. The country produced mostly industrial minerals, which included cement, clay, limestone, marble, and sand and gravel. Gold was produced in small quantities by artisanal miners. Agriculture was the mainstay of the economy, and cotton accounted for about 40% of the gross domestic product (GDP) and about 80% of export earnings (U.S. Department of State, 2009).

In 2008, the real GDP grew by 5% compared with 4.6% in 2007. The growth in the real GDP was attributable to measures taken by the Government to revitalize the agriculture and construction sectors and to improvements in the electricity supply system. Construction activities throughout the year included the building of roads and Government infrastructure, and expansions at the Cotonou airport. Improvements in the provision of electricity were made possible by the rehabilitation and installation of power generators (Organization for Economic Co-operation and Development, 2009).

Benin's exports to the United States were valued at about $31 million in 2008 compared with about $5 million in 2007 and $555,000 in 2006; $15.7 million of these exports were for United States goods returned and reimports (U.S. Census Bureau, 2009b). Imports from the United States were valued at about $846 million in 2008 compared with about $289 million in 2007 and $115 million in 2006. These included nearly $348 million in fuel oil; $38.9 million in petroleum products; $2 million for excavating machinery; $205,000 in specialized mining equipment; and $123,000 for drilling and oilfield equipment (U.S. Census Bureau, 2009a).

Production

Data on mineral production have been estimated for 2008 and are provided in table 1.

Structure of the Mineral Industry

Cement was produced by Ciments du Benin S.A., Société des Ciments d'Onigbolo, and Société des Ciments du Benin. These companies had a combined cement production capacity of 1.43 million metric tons per year (Mt/yr) (table 2). Gold was produced by artisanal miners from gold veins near the villages of Kwatena and Tchantangou, in the Atakora Mountains in northwestern Benin, and from alluvial sediments along the Perma River and its tributaries.

Commodity Review

Mineral Fuels

Petroleum.—Petróleos de Venezuela S.A. was reportedly considering the possibility of building a 500,000-barrel-per-day petroleum refinery in Benin at a cost of $10 billion. The refinery would supply petroleum to Benin, Burkina Faso, and Côte d'Ivoire, as well as other West African countries (Petroleum Economist, 2008).

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BURKINA FASO

Mining did not play a significant role in Burkina Faso's economy. The mining sector, however, could soon begin to contribute significantly to the country's GDP owing to recent developments in the industry, which included the opening of four new gold mines in the past 2 years, the opening of a manganese mine in 2008, and the possible development of another manganese mine and a zinc mine in the near future. The country's investment and mining codes, which were revised in 2004, allowed for the full repatriation of profits and 100% ownership of companies, which reportedly triggered renewed interest by investors in the mining industry, in particular the gold sector. Exploration for copper, gold, and uranium was ongoing throughout the year.

More than 80% of the population relied on subsistence agriculture, and at least 20% of the Government budget was financed from international aid. Investments by French companies accounted for about 70% of total foreign direct investment, although investments in mineral exploration and development were mostly by Australian and Canadian companies. As of January 1, 2008, Burkina Faso reduced the corporate income tax rate to 30% from 35% in 2007, and the tax on dividends, to 12.5%

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from 15%. Burkina Faso imported cement, building materials, fertilizers, and petroleum products (U.S. Department of State, 2009a, p. 2-3, 30-31). Production of mineral commodities in 2008 was limited to cement, dolomite, gold, granite, marble, phosphate rock, pumice and related volcanic materials, and salt.

In August, more than 30 artisanal gold miners reportedly died during a mine collapse at the Konkera mining site near the village of Boussoukoula. The Boussoukoula village is located about 500 kilometers (km) southwest of the capital city of Ouagadogou near the border with Côte d'Ivoire. The Government had banned mining at Konkera temporarily from June to September owing to the possibility of accidents occurring during the rainy season. The number of artisanal miners digging for gold at Konkera was estimated to be about 10,000 (Jeune afrique.com, 2008; Reuters, 2008).

Production

Gold production increased by about 239% to 7,633 kilograms (kg) in 2008 from 2,250 kg in 2007; the increase in gold production was owing to the opening of the Kalsaka, the Mana, and the Youga gold mines. Mineral production data for other mineral commodities produced in Burkina Faso are based on estimates and are provided in table 1.

Structure of the Mineral Industry

High River Gold Mines Ltd. (High River) of Canada through its subsidiary Société des Mines de Taparko (Somita S.A.) operated the Taparko-Boroum gold mine; Cluff Gold plc of Canada in joint venture with IMARB Indústria Metalúrgica of Brazil operated the Kalsaka gold mine; Etruscan Resources Inc. of Canada operated the Youga gold mine; and Semafo Inc. of Canada operated the Mana gold mine. Pancontinental Uranium Corp. of Canada through its subsidiary Crosscontinental Uranium Ltd. and in joint venture with Australian companies Longreach Oil Ltd. and Southern Cross Exploration NL explored for uranium. Gryphon Minerals Ltd. of Australia; Randgold Resources Ltd. of the United Kingdom; and Canadian companies Channel Resources Ltd., Goldbelt Resources Ltd., Orezone Resources Inc., Riverstone Resources Inc., Sanu Resources Ltd., and Volta Resources Inc. continued to explore for gold. Etruscan and Volta also explored for copper. Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Copper.—Volta held three copper/gold prospecting licenses on the Boromo gold belt. The licenses were for the Danyoro, the Malba, and the Souhouera prospects, which made up the 687.5-square-kilometer (km^2) Gaoua project in southern Burkina Faso. The company had begun the second phase of diamond drilling at Gaoua in May and announced in November that it planned to have an initial resource estimate completed for two target areas before the end of the first quarter of 2009 (Volta Resources Inc., 2008; 2009, p. 2-4).

Gold.—The Kalsaka gold mine, which is located about 150 km northwest of Ouagadougou, began production in October. The mine was owned and operated by Kalsaka Mining SA, which was a joint-venture of Cluff (78%), IMARB Indústria Metalúrgica (12%), and the Government (10%). The mine was expected to produce about 1,900 kilograms per year of gold (reported as 60,000 troy ounces) (Cluff Gold plc, 2009).

The Taparko-Boroum Mine, which reopened in September 2007, produced 954 kg (reported as 30,667 troy ounces) of gold in 2008. The mine was 90% owned by High River and 10% owned by the Government. Production in 2008 was lower than expected, and the company attributed this decrease to numerous mill shutdowns throughout the year because of continuing mechanical problems with the mill drive-train. High River expected to correct these problems during 2009 and to produce between 1,960 and 2,360 kg (reported as 63,000 and 76,000 troy ounces) of gold during the year. The company also began a feasibility study for the Bissa Group prospect in 2008 and planned to invest $1.8 million in 2009 to complete the study and determine the viability of a mining and processing facility. The company also planned to invest about $2.5 million in other exploration concessions within the country in 2009 (High River Gold Mines Ltd., 2009, p. 3-16).

The Youga gold mine, which is located in southern Burkina Faso near the border with Ghana, began production during the third quarter of 2008. The mine produced about 911 kg (reported as 29,305 troy ounces) of gold during the year. Gold production for 2009 was expected to be between 2,500 kg and 2,800 kg (reported as 80,000 and 90,000 troy ounces). Gold reserve estimates at the Youga Mine were reported to be 6.8 million metric tons (Mt) at an average grade of 2.7 grams per metric ton (g/t) gold (Etruscan Resources Inc., 2009, p. 1-3).

The Mana gold mine, which began production in early 2008, produced about 2,300 kg (reported as 74,000 troy ounces) of gold during the year. Semafo, which held a 90% interest in the mine through its subsidiary Semafo Burkina Faso S.A., planned to purchase additional mining equipment during 2009 and to make minor facility modifications to increase plant throughput capacity to 6,000 metric tons per day (t/d) from 2,000 t/d. The company also planned to invest $4 million in exploration to evaluate the mine's underground potential (Semafo Inc., 2009, p. 11-12).

Volta held gold prospecting licenses for the 244.5-km^2 Kampti III prospect and for the 48.2-km^2 Bansie prospect, which were located on the Hounde gold belt, and for the 230-km^2 Titao Sud, the 204-km^2 Titao 1, and the 142.2-km^2 Barga II prospects, which made up the Titao gold project, in the Goren gold belt. The company also held a prospecting license for the 123.5-km^2 Dahisma prospect in the San Matenga gold belt (Volta Resources Inc. 2009, p. 4-6).

Manganese.—The Kiere Mine, which is located in the Province of Tuy in southwestern Burkina Faso and operated by Burkina Manganèse S.A.R.L. (a subsidiary of Africa China Mining Corp.), opened in December 2008. The mineral resource of the mine was estimated to be 600,000 metric tons (t) of ore at grades ranging between 45% to 55% manganese (U.S. Department of State, 2009a, p. 31).

Weatherly International plc of the United Kingdom completed a bankable feasibility study for the Tambao

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manganese deposit on behalf of Dubai-based Wadi Al Rawda Industrial Developments. The Tambao deposit is located in the Tambao region about 340 km northeast of the capital city of Ouagadougou. As of yearend 2008, the results of the feasibility study had been submitted to the Government for assessment, together with an environmental impact statement and an application for a mining license. The mineral resource of the envisioned Tambao Mine was estimated to be 19 Mt at a grade of 50% manganese. The mine was expected to produce about 350,000 metric tons per year (t/yr) during the first 2 years of operation, 550,000 t/yr during the third and fourth years and 1 Mt/yr after the fifth year of operation. The ore was to be transported by truck to an existing rail line at Kaya and from there via rail to the Abidjan Port in Côte d'Ivoire. The feasibility study also envisioned the construction of an extension of the rail line from Kaya to the Tambao Mine (Weatherly International plc, 2008; 2009, p. 1, 5).

Zinc.—Blackthorn Resources Ltd. (formerly AIM Resources Ltd.; name changed on December 16, 2008) announced that it had put the Perkoa zinc mine on care-and-maintenance status, reportedly owing to the more-than-50% reduction in the market price for zinc and the adverse effects of the global financial crisis in obtaining additional capital to complete construction projects at Perkoa on terms acceptable to the company. The Perkoa Mine is located in Sanguie Province about 120 km from Ouagadougou, and 35 km from the town of Koudougou. Kougoudou is linked by road to Côte d'Ivoire, Ghana, and Togo, and by rail to Abidjan Port. The mineral resource at Perkoa was estimated to be 6.7 Mt at a grade of 16.4% zinc and 35.4 g/t silver. The mine was expected to produce about 70,000 t/yr of zinc (AIM Resources Ltd., 2009, p.1-7).

Industrial Minerals

Cement.—Burkina Faso had only one cement plant; the plant had a capacity to produce 550,000 t/yr of cement. The plant was owned by West African Cement S.A. of India and operated under its subsidiary, Diamond Cement Burkina S.A. (World Investment News, 2008; U.S. Department of State, 2009b).

Mineral Fuels and Related Materials

Uranium.—In June 2008, Pancontinental Uranium Corp. of Canada through its subsidiary Crosscontinental Uranium Ltd. signed a joint-venture agreement with Australian companies Longreach Oil Ltd. and Southern Cross Exploration NL for the exploration of the Oursi uranium concession area in northeastern Burkina Faso. The Oursi concession tenement, which covers an area of 500 km^2, consists of two areas that are prospective for uranium mineralization; they are known as the Agalsa area and the Tin Dioulaf area. A detailed airborne geophysical survey of the area was completed in October and results reportedly revealed several uranium radiometric anomalies. As of yearend 2008, the joint venture was in the process of conducting ground inspections of the concession area (Pancontinental Uranium Corp., 2008; 2009, p. 9).

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SAO TOME E PRINCIPE

Mining did not play a significant role in Sao Tome e Principe's economy. Agriculture was the mainstay of the economy and accounted for about 16% of the country's GDP. Mineral production was limited to clay and volcanic rock; potential exists, however, for the development of the country's petroleum industry. All other mineral product requirements were imported. The country has traditionally relied on foreign assistance from various donors, including the African Development Bank, the European Union, Portugal, Taiwan, the United Nations Development Program, and the World Bank.

On February 22, 2008, the country was accepted as a candidate country to join the Extractive Industries Transparency Initiative (EITI) and received a grant of support from the EITI multidonor trust fund. Sao Tome e Principe had until March 9, 2010, to undertake EITI validation (Extractive Industries Transparency Initiative, 2009; U.S. Department of State, 2009).

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Commodity Review

Mineral Fuels

Petroleum.—The National Petroleum Agency (NPA) of Sao Tome e Principe was the public entity responsible for the management and implementation of Government policies in all areas related to hydrocarbons, and for tracking and regulating all economic activities related to the petroleum industry. The agency was created by law No. 5 of June 2004. Petroleum Geo-Services (PGS) of Norway, which had been working in Sao Tome since 2001, provided technical training to NPA staff during the year on the use of geo-technical software to be used at a new technical data room at NPA facilities. PGS acquired 10,000 km of marine seismic exploration data to help determine the country's offshore petroleum potential (National Petroleum Agency of São Tomé and Príncipe, 2008, 2009).

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TABLE 1
BENIN AND BURKINA FASO: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Country and commodity		2004	2005	2006	2007	2008
BENIN						
Cement, hydraulic	thousand metric tons	1,100	1,100	1,489 [3]	1,550 [3]	1,500
Clay		21,000	21,000	72,196 [3]	77,295 [3]	77,000
Gold	kilograms	20	20	24 [3]	19 [3]	20
Gravel	cubic meters	29,000	29,000	10,558 [3]	25,348 [3]	25,000
Limestone	thousand metric tons	NA	NA	915 [3]	1,057 [3]	1,000
Marble		NA	NA	278 [3]	342 [3]	300
Sand	thousand cubic meters	NA	NA	5,250	5,500	5,500
BURKINA FASO[4]						
Cement		30,000	30,000	30,000	30,000	30,000
Dolomite	cubic meters	3,000	3,000	3,000	3,000	3,000
Gold	kilograms	1,125 [3]	1,397 [3]	1,571 [3]	2,250 [3]	7,633 [3, 5]
Granite	cubic meters	300,000	300,000	300,000	300,000	300,000
Phosphate rock:						
Gross weight		2,400	2,400	2,400	2,400	2,400
P_2O_5 content		650	650	650	650	650
Pumice and related volcanic materials		10,000	10,000	10,000	10,000	10,000
Salt		5,000	5,000	5,000	5,000	5,000
Stone, marble		100,000	100,000	100,000	100,000	100,000

NA Not available.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through June 30, 2009.

[3]Reported figure.

[4]In addition to the commodities listed, sand and gravel and other construction materials are produced, but information is inadequate to make reliable estimates of output.

[5]Includes artisanal mining, which was estimated to be 1,600 kilograms.

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TABLE 2
BENIN AND BURKINA FASO: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

County and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
BENIN				
Cement		Société des Ciments d'Onigbolo (Amida Group, 100%)	Onigbolo plant	450,000 cement; 500,000 clinker.
Do.		Ciments du Benin S.A. (Scancem International AS, 48.7%)	Cotonou plant	275,000 cement.
Do.		Société des Ciments du Benin (Government, 50%, and LaFarge Group, 50%)	do.	700,000 cement.
BURKINA FASO				
Cement		Diamond Cement Burkina S.A. (West African Cement S.A.)	NA	550,000.
Gold	kilograms	Société des Mines de Taparko (High River Gold Mines Ltd., 90%, and Government, 10%)	Taparko-Boroum Mine 200 kilometers from Ouagadougou	3,100.
Do.	do.	Cluff Gold plc, 78%; IMARB Indústria Metalúrgica, 12%; Government 10%	Kalsaka Mine, 150 kilometers west of Ouagadougou	1,900.
Do.	do.	Etruscan Resources Inc., 90%, and Government, 10%	Youga Mine	2,700.
Do.	do.	Semafo Inc., 90%, and Government, 10%	Mana Mine	3,900.
Manganese		Burkina Manganèse S.A.R.L.	Kiere Mine	NA.
Zinc		Aim Resources Ltd., 90%, and Government, 10%	Perkoa Mine	68,900.[1]

Do, do. Ditto. NA Not available.
[1]On care and maintenance.

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The Mineral Industry of Botswana

By Harold R. Newman

Botswana's mineral resources include base metals, coal, diamond, salt, and soda ash. Mineral exploration and mining in Botswana are regulated by the Department of Geological Survey and the Department of Mines. Mineral exploration in Botswana is difficult. The geology of most of Botswana is poorly understood owing to extensive cover by recent sediments, and available information was based mainly on drilling and geophysical surveys.

The Department of Geological Survey's role is to gather, collate, assess, and disseminate information related to the groundwater, rocks, and mineral resources of the country. It also administered those sections of the Mines and Minerals Act (CAP 01) that relate to mineral exploration (Department of Geological Survey, 2008).

The Department of Mines in partnership with stakeholders provides administrative services; develops policies, programs and legislation for mineral exploitation; and works to prevent occupational diseases and injuries related to mining and to minimize degradation of the environment. The Department of Mines was reviewing the Mines and Minerals Act to ensure that mining license holders make adequate financial provision to fulfill their environmental obligation to rehabilitate the mines at the end of mine life (Department of Mines, 2008).

Minerals in the National Economy

Botswana's mineral resources contributed significantly to Botswana's economic growth. In 2008, Botswana was a leading producer of diamond (by value) and the world's third ranked producer of diamond (in terms of volume) after the Democratic Republic of the Congo and Australia. Copper, gold, and soda ash production also had significant, though smaller, roles in the national economy.

Botswana accounted for about 10% of world diamond production (by volume) and 22% of world diamond reserves. The country's nickel production accounted for about 2% of world production (Kuck, 2009; Olson, 2009).

The worldwide financial crisis had a negative effect on Botswana's mining sector. In 2008, mining accounted for 35.8% of Botswana's real gross domestic product. Diamond production accounted for more than 70% of the value of the mining sector's output and about 75% of merchandise exports. Almost all the country's rough-diamond output was by Debswana Mining Co. (Pty) Ltd., which was a 50-50 joint partnership of the De Beers Group of South Africa and the Government of Botswana. Despite efforts by the Government to diversify the economy, production of gem-quality diamond continued to be the backbone of Botswana's economy (African Economic Outlook, 2008).

Three basic types of mining licenses were granted in Botswana: the reconnaissance permit, the prospecting license, and the mining lease. Mineral rights are the property of the State, irrespective of the ownership of the land on which they are found. Residents of communities in the areas of exploration and mining development cannot claim ownership of mineral rights from existing mines in the country, and the Basarwa and the former residents of the Central Kalahari Game Reserve (CKGR) are no exception. The intent is to ensure that all the citizens have a common stake in and receive common benefits from mineral revenues (Government of Botswana, 2008).

Production

Tati Nickel Mining Co. (Pty.) Ltd. (a subsidiary of MMC Norilsk Nickel of Russia) produced 28,595 metric tons (t) of nickel, 23,146 t of copper, and 337 t of cobalt from its nickel/copper matte. Bamangwato Concessions Ltd. (BCL) of Botswana processed copper-nickel concentrate from its Selebi-Phikwe Mines. Also, BCL toll-smelted concentrate from Tati Nickel's Phoenix open pit mine. IAMGOLD Corp. produced 3,170 kilograms (kg) of gold in 2008 compared with 2,170 kg in 2007 (table 1).

In 2008, diamond production totaled about 32.6 million carats compared with 33.6 million carats in 2007. Production of semiprecious stones totaled about 50,000 kg. Debswana Mining was the major diamond producer. The semiprecious stones were mainly varieties of agate and carnelian, and production was not reported separately. Botswana Ash (Pty.) Ltd. produced salt and soda ash. In 2008, companies extracted clay, crushed stone, gravel, and sand. Production of these industrial materials depended on consumption by the construction industry. Coal production totaled 909,511 t in 2008 compared with 828,164 t in 2007 (Department of Mines, 2008).

Structure of the Mineral Industry

The Government maintained an equity position in most of the major mining companies; however, the mineral industry operated mainly on a privately owned free-market basis. In addition to these major operations, a number of medium- and small-scale mines produced agates, aggregates, clay, and dimension stone. Production information was not readily available for these operations. The country's major commodities and the companies that produced those commodities are listed in table 2.

Commodity Review

Metals

Copper.—Copper exploration projects continued to be active in 2008. African Copper plc had two projects underway. At the Mowana Mine (formerly the Dukwe Mine), construction of the processing plant was completed in 2008, and production of concentrates was started in mid-2008 at the open pit mine. Moolman Mining (Botswana) (a subsidiary of Aveng Ltd. of South Africa) was under contract for the open pit mining

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operation. African Copper found that the inclusion of a dense media separation (DMS) plant into the crushing circuit would allow the cutoff grade to be reduced to 0.1% copper while still maintaining a mill feed that meets the design criteria for the concentrator. The improved recovery potential allowed the company to reengineer the open pit design based on the 0.1% copper cutoff. In addition to the material extracted during open pit mining, African Copper stated that the deposit had an additional 72.9 million metric tons (Mt) of estimated measured and indicated reserves that could be extracted using underground mining techniques. Copper oxide mineralization extends from the surface down to about 70 meters (m) (African Mining Magazine, 2008).

African Copper's other interest was the 3,800-square-kilometer (km^2) Matsitama exploration concession, which is adjacent to the Mowana Mine. Work continued mainly on the Thakadu-Mutsuku corridor. The sampled area covered 2,000 km^2, and analysis identified eight anomalies that had geochemical similarities to the copper, gold, and iron oxide deposits of Australia. Activities during the last quarter of 2008 focused on mapping, prospecting, and soil sampling at 100-m line-spacing. The company indicated that the Thakadu-Mutsuku deposit could be its next mine to open in Botswana. Indicated resources were estimated to total 4.7 Mt grading 1.72% copper at a 0.25% copper cutoff, and inferred estimated reserves were 1 Mt grading 1.29% copper. African Copper also reported an estimated resource of 3.6 Mt grading 16 grams per metric ton (g/t) silver in the Thakadu-Mutsuku deposit (African Copper Ltd., 2008).

Hana Mining Ltd. of British Columbia, Canada, reported the discovery of new copper-silver mineralization at its Ghanzi project. The project consists of five license blocks covering 4,370 km^2 that contain widespread sediment-hosted copper-silver mineralization. Seven vertical percussion holes (HA-01-P to HA-07-P) were drilled on the limb of Zone 2 along a 400-m strike length. Six of the holes intersected mineralization and represented a new discovery in Zone 2. The new discovery is located more than 1,000 m from previously identified mineralization (Hana Mining Ltd., 2008).

Discovery Metals Ltd. of Australia's Boseto copper project comprised 14 prospecting licenses covering an area of more than 10,000 km^2 in northwest Botswana within the Kalahari Copper Belt, which is an underexplored extension of the Zambian Copper Belt. Discovery Metals completed its first and second phases of drilling in 2008. It confirmed substantial copper-silver mineralization at the Petra and the Zeta prospects. It also reported an increase in its estimated total mineral resource of 50.4 Mt grading 1.4% copper, which includes an estimated indicated mineral resource of 8.9 Mt grading 1.4% copper and 20 g/t silver at the Zeta project and an estimated inferred mineral resource of 41.5 Mt grading 1.3% copper at the Petra, the Plutus, and the Zeta prospects. All cutoff grades are 0.6% copper (Discovery Metals Ltd., 2008a).

Gold.—IAMGOLD Corp. operated the Mupane Mine, which was an open pit operation located about 30 kilometers (km) southwest of Francistown. IAMGOLD reported that its gold production from the Mupane Mine in 2008 was 3,170 kg and that the expected life of the mine had been extended to 2012 after decreasing costs gave the company leeway to increase the mineral reserve estimate by 1,815 kg. The company was continuing to evaluate mining costs to determine whether it could develop additional reserves to extend the mine life beyond 2012. IAMGOLD continued exploring for additional ore deposits around Mupane to prolong the life span of its operations in Botswana. IAMGOLD stated that it planned to start mining the deposits at Signal Hill along with possible complementary mining deposits at Golden Eagle and Molomolo; all these deposits are adjacent to the Mupane Mine (Mmegi Online, 2008).

Nickel.—Discovery Metals' Dikoloti nickel project comprised four licenses covering an area of 612 km^2 that surrounds the three nickel deposits of BCL Ltd. in the Selebi-Phikwe region of northeast Botswana. In 2008, the Dikoloti project had an estimated inferred resource of 4.1 Mt grading 0.7% nickel and 0.5% copper at a cutoff grade of 0.5% nickel. Outside of the immediate area of BCL's operating mines, little or no modern exploration had been conducted before the exploration activities of Discovery Metals. Geobiotics LLC's test work for Discovery Metals found that the Dikoloti mineralization was amenable to heap-leach bio-oxidation processing using the GEOLEACH™ process. More than 74% nickel extraction from the ore was achieved after 160 days, and 99% of the extracted nickel could be recovered as a nickel sulfide by the use of sodium sulfide precipitation (Discovery Metals Ltd., 2008b).

Tati Nickel was continuing with its 12-million-metric-ton-per-year (Mt/yr) DMS process. DMS is an ore-upgrading technology and is commonly used as a method of selectively separating 'heavy' particles from the host rock to increase the head grade of run-of-mine material. The DMS plant was expected to increase production to 22,000 Mt/yr from 14,500 Mt/yr of contained nickel and extend the mine life by 7 years to 2019. The Phoenix concentrator was undergoing an upgrade to increase the capacities of the filtration and thickening processes to 700,000 metric tons per year (t/yr) of concentrate from 400,000 t/yr (Infomine.com, 2008).

Albidon Ltd. of Australia announced that drill assays had confirmed thick nickel sulfides at the Sunnyside prospect, which is located in eastern Botswana. Drill hole intercepts indicated a large mineralized zone of 55 m of apparent thickness starting at 21 m from the surface. Sulfides were intersected in 8 drill holes, and mineralization remained open in several directions. The drill results were believed to be the most substantial nickel sulfide intersections in Botswana outside of the Selebi-Phikwe and the Tati nickel mining districts. The Sunnyside prospect forms part of an 8,705-km^2 tenement held by Albidon to the south of Selebi-Phikwe (Albidon Ltd., 2008a).

Albidon signed a joint-venture agreement with IAMGOLD under which Albidon could earn up to 80% interest in nickel exploration projects in the Maitengwe Greenstone Belt in eastern Botswana. The Maitengwe Greenstone Belt is one of a number of greenstone areas that make up large parts of Botswana, South Africa, and Zimbabwe. These greenstone belts contain the majority of nickel resources in southern Africa. An important feature of the Maitengwe Greenstone Belt is its location on a major regional structure that appears to localize substantial nickel mineralization at the Damba and the Hunter's

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Road deposits to the east in Zimbabwe. Structures such as these are of fundamental importance in the formation of large nickel deposits (Albidon Ltd., 2008b).

Industrial Minerals

Cement.—The mineral industry in northern Botswana was expected to get another boost from the Matsiloje Portland Cement Plant when production is restarted at the cement plan. Matsiloje Portland had been closed for several years and required a complete refurbishment. The Department of Mines granted Matsiloje a license, and the plant was on target to start production of 65 metric tons per day (t/d) of cement by yearend 2008. Production was to be increased to 400 t/d in 2009 (Ganetsang, 2008).

Diamond.—Botswana is a participant in the Kimberley Process Certification Scheme, which is an association of the Governments of diamond producing and importing countries, commercial diamond firms, pan-industry associations, and nongovernmental organizations that have implemented a certification system for the international trade of rough diamond. The Kimberley Process is designed to prevent so-called "blood" or "conflict" diamond from being shipped through legitimate trading channels.

The Government and the De Beers Group formed a 50-50 joint venture to build a facility for the sorting and valuation of rough diamond. The venture was named the Diamond Trading Co. Botswana (DTC Botswana) and was intended to ensure that a portion of Botswana's most important natural resource stays in the country longer and that value can be added by local companies. DTC Botswana would sort and value all rough diamond produced by De Beers-Botswana Mining Co. (Debswana) and perform local sales and marketing activities for rough diamond. In addition, the vast majority of De Beers' global production would be aggregated in Botswana by DTC International by 2009 (IM International Mining, 2008).

Botswana produced 32.6 million carats of rough diamond in 2008, which was a decrease of 3.5% from 2007, and sold 28.9 million carats in 2008, which was a decrease of 17% compared with 2007. The country's diamond revenue was expected to be cut in half in 2009 and production was expected to decrease by 35%. Of the 16 diamond companies that held Botswana diamond cutting licenses, 15 were operating and the remaining plant was getting ready to begin diamond cutting (Antwerp World Diamond Center, 2008a).

DTC Botswana was scheduled to start providing the polishing plants for the country with rough diamond in 2008. By 2010, 15% to 20% of cuttable diamond production in Botswana would be processed by the polishing plants. It was estimated that no more than 30% of the rough diamond mined could be cut economically in Botswana. The Government stated that it would take time to train a sufficient number of diamond cutters to do quality local polishing (Antwerp World Diamond Center, 2008c).

Two of Debswana's four mines, the Damtshaa and the Letihakane Mines in the north of the country, were to close at yearend 2008 for 12 months. This was in agreement with calls from worldwide diamond traders to cut rough diamond production in the face of plummeting demand. This action was likely to affect the Government's budget and the economy overall once short-term reserves are exhausted (Antwerp World Diamond Center, 2008b).

DiamondEx Ltd. of Australia announced that commissioning of its Lerala Mine processing plant was completed at the end of August 2008. The plant was operating at a rate of about 100 metric tons per hour; full production of 200 metric tons per hour was expected to begin in 2009. The cost of construction of the Lerala Mine was about $24 million and the expected mine life was 10 years. The mine was expected to produce 300,000 carats per year from indicated reserves of 3.7 million carats. The average grade of the ore was expected to be 27.4 carats per hundred metric tons processed through DMS. The plant was designed with Pans to create a pre-concentrate of fine crushed ore, which is sent directly to the DMS; the remainder of the ore is sent to the tertiary crusher for reprocessing before it enters the DMS. The utilization of both Pans and the DMS in this fashion is unique. This practice reduces the capital cost of the plant by reducing the size of the DMS and it maximizes diamond recovery by minimizing loss (Mbendi Information Services (Pty) Ltd., 2008a).

Prefeasibility studies were being conducted at Debswana's Jwaneng Mine to see if the open pit mine could be expanded or if the mine could be expanded to underground mining. This would be the first time that underground diamond mining would be undertaken in Botswana. As part of the study to mine underground, an exploratory shaft was to be sunk to a depth of 1,000 m about 1.5 km northwest of the open pit. New processing plants were planned for both the Jwaneng and the Orapa Mines. Jwaneng was the richest diamond mine in the world in terms of the value of its production (Hill, 2008a).

Numerous other companies were exploring for diamond in Botswana. Active exploration operations included Firestone Diamonds plc of the United Kingdom, which held diamond exploration rights to 17,000 km^2 in the Jwaneng and the Orapa areas and was the leading holder of diamond exploration rights in the area. Firestone was carrying out two parallel programs at its Tsabong project. The first was an intensive evaluation program on the known diamondiferous kimberlites. The second was an exploration program targeting new kimberlite discoveries. The Tsabong area contains 5 kimberlites that are larger than 50 hectares and 32 kimberlites that are between 20 and 50 hectares in size; it also includes the 180-hectare MK1 pipe, which Firestone indicated was one of the largest known diamondiferous kimberlites in the world (Mukumbira, 2008).

Tawana Resources NL of Australia reported that work on three shafts at its BK24 kimberlite project was started and would be ready for bulk sampling by the third quarter of 2008. Its partner, Botswana-based Nowak Investments, was doing the excavations to a depth of 30 m and building a DMS plant. When the shafts are completed, Nowak is expected to excavate and process 1,100 t/d of kimberlite, which could be increased by as much as 3,000 t/d, if warranted. Nowak could earn a 70% interest in the Orapa prospect by doing a bankable feasibility study on it (Hill, 2008b).

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Coal.—Aviva Corp. Ltd. of Australia announced that it had an estimated resource of 1.3 billion metric tons (Gt) of coal at the Mmamantswe project, which was more than double the amount it proposed seeking when it was granted its prospecting license in 2007. The resource estimate was based on a 3,500-m drilling program. Of the 32 holes drilled, 23 holes intersected coal. The volume was larger than targeted because the thickness of the carbonaceous sequence persisted further to the west than anticipated. Test work indicated that the coal content of the carbonaceous sequence also persisted to the west. The resource estimate affirmed that the Mmamantswe project was a low strip-ratio open pit thermal coal deposit that had the potential to produce 6 Mt/yr. The project is located on the border with South Africa and adjacent to key infrastructure, including highway, railway, and high-voltage transmission lines. Aviva was also investigating the merit of constructing a 1,500-megawatt power station (Louthean, 2008).

Coal reserves in the eastern part of Botswana were estimated to be 17 Gt. In this region, the Karoo Basin was attracting the attention of companies interested in selling energy to the Southern Africa region which has a shortage of electricity. The Coal Investment Corp. (CIC) of Canada was proposing to develop its multibillion-dollar Mmamabula energy project on the edge of this basin; the project would include a coal mine and a powerplant. Coal on the basin's edge is relatively shallow and accessible. The deeper seams of the basin contain rich coalbed methane (CBM) which is also known as coal seam gas. The seams are being evaluated to determine if the resource is of sufficient scale potential to host significant CBM ventures (Van der Merwe, 2008).

Zulu Energy Corp. of the United States spudded its first CBM exploration well on the Pandamatenga licenses in northeastern Botswana in 2008. The well identified as 2008-01 was expected to reach a depth of between 600 and 800 m through the Kalahari Sands and the Stormberg lavas. Zulu Energy had identified six sites on which it planned to carry out drill core desorption tests for 18 stratigraphic exploration drill holes to determine the location of the gas. The Pandamatenga licenses cover about 890,000 hectares in an extension of the mid-Zambezi Basin. Zulu Energy considered that the area had a strong potential for CBM hosted in the Lower Ecca Group of the Permian age Karoo Supergroup (Izundu, 2008).

Zulu Energy announced that it had spudded two additional wells (2008-02 and 2008-04) under its CBM exploration program, which brought to three the number of wells underway in 2008. The 2008-02 well was expected to be drilled to a depth of 1,200 m; the 2008-04 well was expected to be drilled to a depth of 900 m to the coal-bearing Lower Ecca Group. The company announced that it had identified three additional sites and expected to begin drilling by yearend 2008 (Mbendi Information Services (Pty) Ltd., 2008b).

Natural Gas.—Zulu Energy announced that it had unexpectedly hit natural gas while drilling for CBM. The surprise discovery occurred during exploratory drilling by Nyati Resources Botswana (Pty) Ltd., which was a wholly owned subsidiary of Zulu Energy. Nyati Resources announced that, as a precautionary measure, the well was temporarily shut until the required safety equipment was mobilized and installed at the drilling location. The company announced that a drilling specialist had been hired to plan and execute reentry operations. The gas was encountered in sandstones of the Upper Karoo Group, beneath the Kalahari sand and the Stormberg lava (Tradingmarkets.com, 2008).

Uranium.—A-Cap Resources Ltd. of Australia announced that the initial inferred mineral resource at its Kraken and Mokobaesi prospects in northeastern Botswana contained an estimated 9,000 t of uranium oxide. The prospects were part of the larger Letlhakane project, which had an inferred resource of 13,600 t of uranium oxide. A-Cap was proceeding with plans to complete the development of the Letlhakane Mine and start production by 2011. A-Cap expected its feasibility study to be completed in 2009, after which the company would seek approval of a mining license from the Government. An environmental impact assessment was initiated at yearend 2008. A-Cap announced that it had discovered new uranium deposits near Serule in the Central District, where the company had another prospecting license that covered 4,500 km^2 (Benza, 2008).

Impact Minerals Ltd. announced it had been granted uranium exploration licenses for an area covering more than 20,000 km^2 in eastern Botswana. The licenses covered about 350 km of the strike extension of rocks that host deposits and prospects near the town of Serule and along strike with the Mokobaesi deposit of A-Cap resources and the Foley prospect, which was discovered by African Energy Resources Ltd. Preliminary interpretation of airborne radiometric data identified a large number of radiometric anomalies that will be investigated with ground prospecting activities. Field work was planned to start in mid-year 2008 (Mining Top News, 2008).

Outlook

International interest in exploration for diamond and base and precious metals and uranium is expected to continue. The country's favorable geologic environment, mineral investment climate, low tax rates, and political stability are expected to continue to make Botswana an attractive country for foreign mineral investment. Revenues from diamond operations that were affected by the international financial crisis are expected to recover in the near future. The several international companies with active exploration programs for mineral resources are expected to continue to operate in Botswana. Copper, gold, nickel, and soda ash production and processing are expected to continue to be notable factors in the country's economy.

Given the country's extensive coal resources and projected regional power demand, Botswana is expected to continue to develop and support CBM resources. Additional coal-fueled electricity-generating plants could be constructed to supply power to the Southern African power pool.

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TABLE 1
BOTSWANA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
Clay[e]		50,000	50,000	50,000	50,000	50,000
Coal, bituminous		913,087	984,876	962,427	828,164	909,511 [3]
Cobalt, smelter output, Co content of matte[4, 5]		223	326	303	242	337 [3]
Copper:						
Mine output, Cu content of ore milled		29,460	31,300 [e]	24,255	21,500 [e]	22,000
Smelter output, matte, gross weight[4]		54,448	68,637	64,368	53,947	48,000
Smelter output, Cu content of matte[4, 5]		21,195	26,704	24,255	19,996	23,146 [3]
Diamond[6]	thousand carats	31,125	31,890	34,293	33,639	32,595 [3]
Gemstones, semiprecious[6]	kilograms	99,000	165,000	65,000	48,000 [e]	50,000
Gold[8]	do.	161	2,709	3,020	2,722	3,176 [3]
Nickel:						
Mine output, Ni content of ore milled		35,163	39,305	38,000 [e]	27,600 [e]	28,940 [3]
Smelter output, matte, gross weight[4]		54,448	68,637	64,368	53,947	54,000
Smelter output, Ni content of matte[5]		22,292	28,212	26,762	22,844	24,000
Salt[9]		208,319	243,945	151,595	165,710	170,994 [3]
Sand and gravel[10]	thousand cubic meters	2,330	1,906	4,812	2,866	3,000
Soda ash, natural		263,358	279,085	255,677	279,625	263,566 [3]
Stone, crushed	thousand cubic meters	1,219	1,100	1,134	1,200 [e]	1,200

[e]Estimated; estimated data are rounded to no more than three significant digits. do. Ditto.

[1]Table includes data available through August 1, 2009.

[2]In addition to commodities listed, palladium, platinum, and silver were produced, and exported in the nickel-copper-cobalt m atte; copper and nickel cathodes also were produced at a pilot plant, but information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Smelter product was granulated nickel-copper-cobalt matte.

[5]Included some product from direct smelting of ore; that is, ore not reported as milled.

[6]Assumed to contain about 70% gem and near gem.

[7]Principally agate. Reported as sales.

[8]Reported as bullion; historically included silver estimated to be about 2%. Includes artisanal production

[9]Byproduct of natural soda ash production.

[10]Includes clay (for brick and tile).

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TABLE 2
BOTSWANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Clay[1]		Lobatse Clay Works (Pty.) Ltd. (Botswana Development Corp. and Interkiln Corp. joint venture)	Lobatse, 70 kilometers south-southwest of Gaborone	50,000.[e]
Do.		Makoro Brick and Tile (Pty.) Ltd.	Makoro, 10 kilometers south of Palapye	20,000.[e]
Coal		Morupule Colliery (Pty) Ltd. (Anglo American Corp. of South Africa Ltd. and related firms, 93.3%)	Morupule, 270 kilometers northwest of Gaborone	1,000,000.
Diamond	thousand carats	Debswana Diamond Co. (Pty.) Ltd. (Government, 50%, and De Beers Centenary AG, 50%)	Jwaneng Mine, 115 kilometers west of Gaborone	12,000.
Do.	do.	do.	Orapa Mine, 375 kilometers north of Gaborone	13,000.
Do.	do.	do.	Letlhakane Mine, 350 kilometers north of Gaborone	1,000.
Do.	do.	do.	Damtshaa Mine, 220 kilometers west of Francistown	670.
Do.	do.	Tswapong Mining Co. (Pty.) Ltd. (De Beers Prospecting Botswana Ltd., 85%, and Government, 15%)	Tswapong Mine, 275 kilometers northeast of Gaborone	3.
Gemstones, semiprecious	kilograms	Agate Botswana (Pty.) Ltd.	Processing plant at Pilane, 45 kilometers north of Gaborone	60,000.
Gold	do.	IAMGOLD Corp.	Mupane Mine, near Francistown	3,100.
Nickel-copper-cobalt		Bamangwato Concessions Ltd. (BCL), (Government, 15%, and Botswana RST Ltd., 85%, of which LionOre Mining International Ltd., 12.65%)	Selebi-Phikwe Mines, 350 kilometers northeast of Gaborone	3,000,000 ore matte content (of which 30,000 nickel, 25,000 copper, 400 cobalt).
Do.		Tati Nickel Mining Co. (Pty.) Ltd. (LionOre Mining International Ltd., 85%, and Government, 15%)	Phoenix and Selkirk Mines, 23 kilometers east of Francistown	3,600,000 ore matte content (of which 15,000 nickel, 9,000 copper, 100 cobalt, 960 kilograms palladium, 145 kilograms platinum).
Do.		Masa Precious Stones (Pty.) Ltd.	Bobonong, east of Selebi-Phikwe	4,000.
Salt		Botswana Ash (Pty.) Ltd. (Government, 50%, and Anglo American plc, 50%)	Sua Pan, 450 kilometers north of Gaborone	650,000.
Soda ash		do.	do.	300,000.

[e]Estimated.
[1]For brick and tiles.

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The Mineral Industry of Burundi

By Thomas R. Yager

In 2008, Burundi's production of gold, limestone, niobium (columbium) and tantalum ore and concentrate, peat, sand and gravel, tin ore, and tungsten ore was not significant in global terms. Burundi was not a globally significant consumer of minerals. Manufacturing, mining, and energy accounted for nearly 11% of Burundi's gross domestic product in 2007 (the latest year for which data were available) (Banque de la République du Burundi, 2008, p. 2).

Production

In 2008, tantalum production increased by 79%; niobium, 64%; and tungsten, 35%. Tin output also increased sharply. From 2004 to 2008, niobium production increased by 257%, and tantalum production, by 225% (Damien Riragonya, Director General of Mines and Geology, Burundi Ministry of Energy and Mines, written commun., July 21, 2009).

Structure of the Mineral Industry

Privately owned Comptoir Minier des Exploitations du Burundi S.A. (COMEBU) and artisanal miners produced Burundi's gold, niobium, tantalum, tin, and tungsten. Gold reportedly was mined in Citiboke and Muyinga Provinces, and niobium, tantalum, tin, and tungsten were mined in Kayanza and Kirundo Provinces. State-owned Office National de la Tourbe (ONATOUR) was the country's only producer of peat.

Commodity Review

Metals

Cobalt, Copper, and Nickel.—Dwyka Resources Ltd. of Australia and BHP Billiton Ltd. of Australia engaged in exploration at Dwyka's Muremera Nickel project in northeast Burundi. BHP Billiton could earn 50% interest in the project if it spent $5.2 million on exploration at Muremera. In the first phase of exploration, BHP Billiton spent $4.2 million; the second phase started with a drilling program in the third quarter of 2008 (Dwyka Resources Ltd., 2008).

In June 2007, the Government canceled the license for the Musongati nickel deposit in southeast Burundi held by Argosy Minerals Inc. of Australia. Argosy filed complaints with the International Court of Arbitration in France in an attempt to regain control of the deposit. At the end of 2008, the dispute was unresolved (Mining Journal, 2007; Argosy Minerals Inc., 2009).

Gold.—Burundi's gold exports amounted to 2,170 kilograms (kg) in 2008. Between 500 and 1,000 kilograms per year were estimated to be produced locally by artisanal miners; the remainder was reportedly reexported from the Democratic Republic of the Congo (United Nations Security Council, 2007, p. 22).

International Gold Exploration AB (IGE) of Sweden engaged in exploration at the Butara gold deposit in northwestern Burundi in 2008. The company planned to complete its prefeasibility study of mining at Butara in 2009 and hoped to identify resources of at least 31,000 kg of contained gold (International Gold Exploration AB, 2008a, p. 35-37; 2008d, p. 5).

Niobium and Tantalum.—The Kabarore Mine produced niobium and tantalum on an artisanal scale. IGE engaged in exploration at Kabarore in 2008; the company was considering plans to start large-scale mining in a joint venture with COMEBU. In July, IGE decided to withdraw from Kabarore because characteristics of the deposit's ore restricted the recovery rate of tantalum pentoxide to 50%, which the company considered to be subeconomic (International Gold Exploration AB, 2008b).

Vanadium.—IGE engaged in exploration at the Mukanda vanadium deposit in 2008. The company planned to complete its prefeasibility study and reach a decision about investment in a new mine in 2009. Resources at Mukanda amounted to 17 million metric tons that graded 0.64% vanadium; IGE hoped to identify additional contained vanadium resources of nearly 100,000 metric tons. Based on favorable results from the study, the new open pit mine could produce 10,000 metric tons per year of vanadium pentoxide during a mine life of at least 20 years (International Gold Exploration AB, 2008a, p. 35-36; 2008d, p. 5).

Mineral Fuels and Related Materials

Peat.—ONATOUR produced peat from the Buyongwe, the Gisozi, the Gitanga, and the Matana deposits. The company's production declined by 23% in 2007 because of frequent mechanical problems with mining equipment (Banque de la République du Burundi, 2008).

Petroleum.—In October 2008, the Government awarded an exploration license for Block D on Lake Tanganyika to Surestream Petroleum Ltd. of the United Kingdom. Surestream planned to start exploration at Block D in June 2009 (Africa Energy Intelligence, 2009).

Uranium.—In July 2008, the Government awarded IGE an exploration license for the Musigati area in northwest Burundi. IGE planned to explore for uranium and gold at Musigati, which is adjacent to the Butara gold deposit (International Gold Exploration AB, 2008c).

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TABLE 1
BURUNDI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
Gold, mine output, Au content[e]	kilograms	750 [r]	750 [r]	750 [r]	750 [r]	750
Niobium (columbium) and tantalum, ore and concentrate:						
Gross weight	do.	23,356	42,592	16,177	51,550	83,854
Nb content	do.	4,598	8,384	3,200	10,000	16,400
Ta content	do.	5,038	9,188	2,868	9,140	16,371
Peat		4,643	4,871	9,762	7,489 [r]	7,500 [e]
Tin, mine output:						
Gross weight		19	8	79	5	50
Sn content		9	4	46	2	21
Tungsten, mine output:						
Gross weight		24	295	668	455	608
W content		8	94	238	144	194

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto.
[1]Table includes data available through August 28, 2009.
[2]In addition to the commodities listed, brick clay, limestone, and sand and gravel were produced, but available information is inadequate to make reliable estimates of output.

TABLE 2
BURUNDI: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity[e]
Gold	kilograms	Artisanal miners	Citiboke and Muyinga Provinces	750
Niobium (columbium) and tantalum, columbite-tantalite ore and concentrate		Comptoir Minier des Exploitations du Burundi S.A. (COMEBU)	Kabarore in Kayanza Province and Murehe in Kirundo Province	84
Peat		Office Nationale de la Tourbe (ONATOUR)	Buyongwe, Gisozi, Gitanga, and Matana	20,000 [1]
Tin, cassiterite ore and concentrate		Comptoir Minier des Exploitations du Burundi S.A. (COMEBU)	Murehe in Kirundo Province	190
Tungsten, wolframite ore and concentrate		Artisanal miners	Vumbi in Kirundo Province	38
Do.		do.	Busoni in Kirundo Province	37
Do.		do.	Kirundo in Kirundo Province	12

[e]Estimated. Do., do. Ditto.
[1]Reported figure.

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The Mineral Industries of Cameroon and Cape Verde

By Harold R. Newman

CAMEROON

Cameroon has significant mineral resources of bauxite, cobalt, iron ore, nickel, and uranium. Mining of these resources, however, was limited. Other mineral deposits included cassiterite, marble, mica, lignite, rutile, and tantalite. Considerable development of the country's mining infrastructure would be required to exploit these resources.

All mineral resources belong to the state. Prospecting, exploration, and mining activities for any mineral deposit are regulated by permit. The Ministère de l'Eau et de l'Energie (Ministry of Water and Energy) is responsible for the administration of the mineral industry in accordance with the Mining Law of 2001 and the Petroleum Code of 2000.

In 2008, the following five companies had active exploration programs: African Aura Resources Ltd. of the United Kingdom (gold), Geovic Cameroon plc of Canada (cobalt-manganese-nickel), Hydromine Inc. of the United States (iron ore), Mega Uranium Ltd. of Canada (uranium), and Sundance Resources Ltd. of Australia (iron ore). In 2008, the Government began planning for a new port, a hydroelectric plant, and railway projects (U.S. Department of State, 2008).

The mining sector had not been a priority of the Government in the past; however, that appeared to be changing in 2008. The Government was attracting new investors that it hoped would invest $10 billion in the mineral sector during the next few years. The Government revised its Mining Law of 2001 which, starting in 2008, would give investors new incentives, such as a 5-year tax break and free transfer of capital out of the county (Musa, 2008a).

Production

In 2008, the petroleum sector continued to be the most significant segment of Cameroon's mineral industry, and petroleum products were the main export items. Other mineral commodities produced in the country were aluminum (from alumina imported from Guinea), cement, and sand. Small-scale artisanal miners recovered diamond throughout the country. Gold was also recovered by small-scale artisanal miners in the eastern and northern parts of the country from alluvial and elluvial deposits. A variety of industrial minerals and other construction materials, such as aggregates, gypsum, and stone, were also produced for local consumption.

Structure of the Mineral Industry

The mineral industry of Cameroon was modest in size and mostly privately owned. The major mineral producers were Cimenteries du Cameroun (cement), Société Nationale de Raffinage (SoNaRa) (petroleum), and Compagnie Camerounaise de l'Aluminium (aluminium). SoNaRa was 66% owned by the Government and the remaining interest was owned by several petroleum companies. Table 2 is a list of the major mineral industry facilities.

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Three companies—Dubai Aluminum Co. Ltd. of the United Arab Emirates, Hindalco Industries of India, and Hydromine Inc. of the United States—signed a joint-venture agreement to develop a bauxite and alumina complex and a railway line that would link the complex to the Port of Douala. Cameroon Alumina Ltd. (CAL) would be the operating company to exploit the 1.2-billion-metric-ton (Gt) bauxite deposit near Ngaoundere.

The plant was expected to start up in the next 2 to 5 years at a cost of $5 to $6 million and would process the ore from the bauxite deposits at Minim-Martap and Ngaoundal in Adamawa Province. The Government stated that Cameroon had estimated bauxite reserves of about 1.2 Gt. Major infrastructure works would be required by the Government, including construction of 1,000 kilometers (km) of road to link the Minim-Martap and the Ngaoundal deposits to the coast (Musa, 2008b).

Whinnen Resources Ltd. of Australia announced that it had acquired an 85% interest in the 9,160-square-kilometer (km^2) Fongo Tongo property as part of its acquisition of the Yekani Mining Co. (Cameroun) S.A. of South Africa. The remaining 15% interest was held by local investors. The project was estimated to have probable reserves of 34 million metric tons (Mt) of bauxite at a grade of 47% aluminum trioxide (Al_2O_3). The project is located 14 km northwest of Dschang and was considered to be a high-grade deposit relative to other deposits around the world (Mukumbira, 2008).

Cobalt.—Geovic Cameroon plc [GeoCam] (a subsidiary of Geovic Mining Corp. of the United States) had the following seven near-surface cobalt and nickel deposits in Cameroon: the Kondong, the Mada, the Messea, the Nkamouna, the North Mang, the Rapodjombo, and the South Mang. GeoCam was planning to start mining cobalt and nickel at the Nkamouna laterite deposit possibly in late 2010. Nkamouna would be GeoCam's first deposit to be developed. Nkamouna's estimated proven and probable reserves were 54.7 Mt at average grades of 0.25% cobalt and 0.69% nickel. This reserve was expected to yield about 11.7 Mt of concentrates grading 0.74% cobalt and 0.99% nickel. Mining would be by open pit, and processing would be by atmospheric leaching after crushing, washing, and screening to upgrade the ore (Geovic Mining Corp., 2008).

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The Mada deposit is an extension of the adjoining Nkamouna deposit and was to be the second of the seven properties to be developed. The purpose of drilling out Mada was to determine if it contains additional high-grade reserves for utilization at the planned Nkamouna processing plant and to provide additional resources to significantly increase production if supported by market conditions. The deposit has very similar geologic properties and ore grades to the Nkamouna deposit and has estimated inferred resources of 145 Mt of cobalt (Market Watch, 2008).

Gold.—African Aura Resources Ltd. of Australia was continuing with license acquisition and exploration in 2008. Exploration included the Batouri project in eastern Cameroon where it reported further high-grade intersections by its diamond drilling program. Twenty-nine drill holes on the Kambe trend intersected 2.7 meters (m) of material grading 65.9 grams per metric ton (g/t) gold and 1.5 m grading 43.3 g/t gold. Kambe is 3.5 km in length and, in places, up to 500-m wide. Results from Kambe in 2008 indicated good correlation between surface geochemical anomalies and potassic alteration as defined by a geophysical survey, and the presence of high-grade gold-bearing quartz veins (MBendi Information Services (Pty) Ltd., 2008a).

Drilling by Africa Aura was also underway at the Dimako prospect. African Aura had core drilled 11 holes of a planned 25-hole drilling program to test the 3.5-km-long Dimako-Mongonam sheer zone. Dimako is located 7 km south of Kambe. Drilling had intersected 12.9 g/t for a distance of 2.4 m and 16.4 g/t for a distance of 1.1 m (Mbendi Information Services (Pty) Ltd., 2008b).

Iron Ore.—The Government announced that China Harbor Engineering Corp. of China, Rio Tinto plc of the United Kingdom, and Sundance Resources were among the companies shortlisted to build a $650,000 port in Cameroon. The proposed new port at Grand Batanga near Kribi would be able to take much larger vessels than the main port at Douala. The port at Douala is restricted in the size of the ships it can handle owing to its location on the sediment-filled River Wouri estuary, which requires constant dredging. The Government was aiming to attract investment in its bauxite, cobalt, iron ore, nickel, and uranium deposits in the next few years, and improved infrastructure, including ports, was a key part of the drive. The new port would be linked by road and rail to mining projects under development in the interior (Creamer Media (Pty) Ltd., 2008).

Sundance Resources continued with planning efforts in 2008 to exploit iron ore at its $2.5 billion Mbalam project. The ore deposit is located near the Gabon border and was expected to produce 35 million metric tons per year (Mt/yr) of iron ore during a period of 20 years. Sundance Resources announced that it had increased its estimated inferred resource to 2.2 Gt of itabirite hematite at 40% iron content at the Mbarga deposit within the Mbalam project. Itabirite hematite was preferred by steel mills for use as direct-reduction-grade feed owing to its very low alumina, phosphorus, and silica content (MBendi Information Services (Pty) Ltd., 2008c).

African Aura was continuing exploration work on the Nkout structure on the Djoum permit. A program of diamond core drilling was to be carried out in 2008 on 3 km of the structure, which was 10-km long and includes reconnaissance drilling on 10 sites to a depth of 100 m. The aim was to confirm that the average grade of the ore at the surface was between 54% and 65% iron content. The Djoum Block covers an area of 1,000 km^2 and was owned by Caminex SARL (a wholly owned subsidiary of African Aura) (African Mining Intelligence, 2008).

Titanium.—Gilla Inc. of the United States announced that it had two exploration permits for rutile: the Akonolinga rutile project, known under the name of Mfoumou, and the Nanga Eboko rutile project, known as Sele. These properties are located about 100 km east of Yaounde. Extensive testing has been done by the Bureau de Recherches Geologiques et Minieres (BRGM). The BRGM reported that its testing indicated an estimated resource of 3 Mt of rutile at a grade of 1%. This potential represents the world's second largest rutile deposit after Sierra Leone's (Marketwire Inc., 2008).

Industrial Minerals

Cement.—The project to build a second cement plant, to be located at Limbe, was formalized in 2008 between the Government and a consortium of companies from the United States and the Republic of Korea. An agreement was reached that defined the obligations of the parties and covered production, marketing, and research. The consortium would be named the AFKO Cement Production Co. The $82.7 million plant was to have a capacity of 1 Mt/yr and would produce different qualities of cement, including cement for use in marine construction and the building of bridges. Construction of the plant was expected to be completed by January 2010 (Nyuylime, 2008).

Mineral Fuels and Related Materials

Petroleum.—Cameroon's petroleum reserves are located offshore in the Rio del Rey Basin, offshore and onshore in the Douala and the Kribi-Camp Basins, and onshore in the Logone-Birni Basin in the northern part of the country. The country has experienced a fairly steady decline in its domestic petroleum production during the past 20 years. The country has been well explored; however, no new discoveries have been found. As of January 2006, Cameroon had estimated proven petroleum reserves of 400 million barrels, with the majority of reserves located offshore in the Douala Kribi Basin of the Niger Delta. Cameroon's only refinery, which is located in the port city of Limbe, had a capacity to produce 45,000 barrels per day (bbl/d) and was operated by SoNaRa (U.S. Energy Information Administration, 2008).

Addax Petroleum Corp. of Canada signed a production-sharing contract (PSC) with the Government for the Iroko license area in the Gulf of Guinea. Iroko is located 30 km offshore in the Rio del Rey basin where the majority of Cameroon's production is located. Under the PSC, Addax was to undertake a work program valued at $17.5 million in the first 3 years to acquire three-dimensional seismic data and drill one well in the 15.6-km^2 license area (Engineering News, 2008).

CityView Corp Ltd. of Australia announced that it planned to buy a 55,000-bbl/d refinery from Tagore Investments S.A. of the United Kingdom and to relocate it to the west coast by the

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first quarter of 2010. The refinery was being rebuilt in Houston, Texas. CityView would debt finance most of the $320 million needed to purchase and relocate it. The refinery was expected to produce 17,370 bbl/d of gasoline, 13,964 bbl/d of kerosene and diesel, 8,772 bbl/d of fuel oil, 4,560 bbl/d of asphalt, 3,784 bbl/d of naphtha, and 1,550 bbl/d of liquid petroleum gas. The capacity of the refinery would be increased to 100,000 bbl/d after relocation. The refinery's location was not decided at the time of the announcement (Izundu, 2008).

Uranium.—Mega Uranium Ltd. of Canada had a 92% interest in Mega Uranium Cameroon plc, which held the following three properties: the Kitongo (which covered an area of 2,578 km^2), the Lolodorf (994 km^2), and the Teubang (1,082 km^2). Limited historical drilling in small portions of the Kittongo and the Lolodorf properties intersected significant uranium mineralization. The uranium mineralization occurs as disseminated uraninite in wide zones of albitized granite and in high-grade veins. Mega commenced a 2,850-m diamond drilling program at Kitongo that consisted of 10 drill holes from five sites along a 300-m length of the Kitongo fault scarp, which marks the contact between the Kitongo granite and metasediments of Middle Proterozoic age. At each of the five sites, the program consists of one horizontal hole of 300- to 350-m length, and one inclined hole at an angle of 45° to a depth of between 250 and 300 m (Thompson Reuters Corp., 2008).

Africa Aura announced that its 70% owned subsidiary Ridgeway Energy Ltd. had been awarded two licenses that were considered prospective for uranium. The licenses total about 1,992 km^2. The Ekomedion license, which covers 992 km^2, is located in west central Cameroon and targets granite-hosted and unconformity-type deposits; the Mbanga license is located in west central Cameroon and targets coarse grained, partially conglomeratic sandstone. Ridgeway stated that it intended to undertake a vehicle-borne radiometric survey across these two licenses to prioritize anomalies for followup exploration (Ridgeway Energy Ltd., 2008).

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CAPE VERDE

Cape Verde is an archipelago of 10 islands and 8 islets located about 600 km off the western coast of Africa. Mining's contribution to the country's economy was very minimal. Most of the country's mineral requirements were imported. Production of mineral commodities was limited mainly to cement and salt for local consumption. Cape Verde was not a producer of mineral fuels in 2008.

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TABLE 1

CAMEROON AND CAPE VERDE: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Country and commodity[3]		2004	2005	2006	2007	2008
CAMEROON						
Aluminum metal, primary		85,900 [4]	86,977 [4]	87,000	89,500 [4]	91,000
Cement, hydraulic		1,032,438 [4, 5]	1,000,000	1,000,000	1,150,000 [4]	1,000,000
Clay		15,734 [4]	9,811 [4]	10,000	10,000	10,000
Diamond	carats	12,000	12,000	12,000	12,000	12,000
Gold, mine output, Au content[6]	kilograms	1,500	1,889 [4]	2,000	2,000	1,800
Petroleum:						
Crude	thousand 42-gallon barrels	34,675 [4]	30,100 [4, 7]	31,667 [4]	30,364 [4, 7]	31,000
Refinery products	do.	12,000	12,000	12,000	12,000	12,000
Pozzolana, ash for cement		600,000	600,000	600,000	600,000	600,000
Sand and gravel		601,000	601,000	600,000	600,000	600,000
Sapphire	kilograms	1,000	1,000	1,000	1,000	1,000
Silica sand		14,000	14,000	14,000	14,000	14,000
Stone:						
Limestone		103,000	103,000	100,000	100,000	100,000
Marble		500	500	500	500	500
CAPE VERDE[8]						
Cement		150,000	150,000	160,000	160,000	160,000
Salt		1,600	1,600	1,600	1,600	1,600

do. Ditto.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through June 30, 2009.

[3]In addition to the commodities listed, a variety of industrial minerals and construction materials (aggregate, gypsum, and stone) are produced, and bauxite may be produced but information is inadequate to make reliable estimates of output. The National Institute of Statistics reports salt production to be less than 1 metric ton per year.

[4]Reported figure.

[5]Reported by the National Institute of Statistics of Cameroon.

[6]From artisanal mining.

[7]Reported by the U.S. Energy Information Administration.

[8]Cape Verde also produced clay, gypsum, limestone, and pozzolana, but output is not reported, and available information is inadequate to make reliable estimates of output.

TABLE 2

CAMEROON AND CAPE VERDE: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location	Annual capacity
CAMEROON				
Aluminum		Compagnie Camérounaise de l'Aluminium (Alcan Inc., 46.7%)	Plant at Edea	95
Cement		Cimenteries du Cameroun (Lafarge Group, 57%)	Plant at Bonaberi near Douala	1,200
Diamond	carats	Artisanal	Various locations	12,000
Gold	kilograms	do.	do.	1,500
Limestone		Cimenteries du Cameroun (Lafarge Group, 57%)	Figuil	275
Petroleum, refinery	barrels per day	Société Nationale de Raffinage (SoNaRa) (Government, 66%)	Refinery at Limbe	45,000
Pozzolana		Cimenteries du Cameroun (Lafarge Group, 57%)	Sud-Quest and Littoral Provinces	750
CAPE VERDE				
Cement	metric tons	Cimentos de Cabo Verde S.A.	Plant at Santiago	160,000
Salt	do.	Artisanal	Various locations	1,600

do., Ditto.

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The Mineral Industries of Central African Republic, Côte d'Ivoire, and Togo

By Omayra Bermúdez-Lugo

CENTRAL AFRICAN REPUBLIC

Clay, diamond, gold, limestone, quartz, and sand and gravel were the only mineral commodities reported as being produced in Central African Republic. The country's undeveloped mineral resources included copper, graphite, ilmenite, iron ore, kyanite, lignite, manganese, monazite, quartz, rutile, salt, tin, and uranium. On November 21, 2008, Central African Republic was accepted as a candidate country to join the Extractive Industries Transparency Initiative (EITI). The EITI is a voluntary global compact for improving transparency in countries whose economies are dependent on the mining industry by having the Government disclose the payments and revenues received from companies engaged in mining operations within the country. Central African Republic had until November 20, 2010, to undertake validation (Extractive Industries Transparency Initiative, 2008).

Production

Production of gold and diamond, which was mostly artisanal, came from the regions of Berberati, Haute-Kotto, and Haute-Sangha. In 2008, diamond production decreased by 19.3% to 377,209 carats from 467,711 carats produced in 2007. Production of other mineral commodities was estimated for 2008. Data on mineral production are in table 1.

Structure of the Mineral Industry

The Ministry of Mines, Energy and Water was the Government agency responsible for the mining sector. Production and trade of diamond and gold were overseen by Bureau d'Evaluation et de Côntrole de Diamant et d'Or (BECDOR). BECDOR maintained the country's diamond and gold production database and assessed the value of diamond parcels that came from the various diamond exporting companies (collectively known as bureaux d'achat) operating in the country.

Commodity Review

Metals

Gold.—AXMIN Inc. of Canada continued to work on the development of the Passendro gold project, which is located about 60 kilometers (km) from the town of Bambari. A bankable feasibility study for Passendro was completed in April 2008. The study was released in March 2008 and included the results of drilling completed as of the end of June 2007. Following the drilling campaign, AXMIN hired SRK Consulting (UK) Ltd. (SRK) to undertake geologic modeling and resource estimation of the seven gold mineralized deposits that together made up the Passendro project, namely Bacanga Head, Baceta, Barbacoa, French Camp, Katsia, Main Zone, and Ngetepe. Following the study, a 17% increase in measured and indicated resources was reported as compared with a resource estimate obtained from a feasibility study conducted in 2006. In November, the Government approved AXMIN's environmental and social impact assessment and, as of yearend, the company was in the process of applying for a mining license. AXMIN planned to develop an open pit mine operation that would produce about 6,900 kilograms per year (kg/yr) of gold (reported as 223,000 troy ounces) during the first 3 years of operation and would then produce an average of 6,300 kg/yr of gold (reported as 203,000 troy ounces) for the remaining life of the mine, which was estimated to be 5.9 years. Gold production was expected to begin in 2010 (Axmin Inc., 2008a, c; 2009, p. 2-4).

London-based Pan African Resources plc signed mining conventions for the exclusive exploration rights to the Bogoin gold prospect, which is located in southwestern Central African Republic about 120 km north of the capital city of Bangui, and for the Dekoa gold prospect, which is located in the west-central part of the country about 330 km from Bangui. The conventions were for a period of 25 years each. A rotary air-blast drilling program and a 2,062-meter (m) reverse-circulation drilling program were completed at the Bogoin prospect during the year. The Dekoa prospect hosted six major gold-in-soil anomalies with an interpreted strike length of 25 km. These anomalies were discovered through a regional stream sediment sampling program. Pan African operated in Central African Republic under its subsidiary Or Oubangui S.A. (Pan African Resources plc, 2009, p. 11, 19).

Iron Ore.—AXMIN continued to explore for iron ore at the Topa Hill iron ore prospect. Topa Hill, which was discovered by AXMIN in 2006, is located within the company's Bambari-Bakala concession and consists of two iron-rich-northwest-trending ranges of hills that reportedly contain ore grading about 64.3% iron on average. In April 2008, the company announced that high-grade iron assays were obtained from initial core drilling at Topa with a weighted average of 63.1% iron across true widths ranging from 10 to 52 m to a maximum tested depth of 150 m. The company planned to move its drilling program to the East Limb Hills of the Topa Hill prospect during 2009 (Axmin Inc., 2008b).

Industrial Minerals

Diamond.—London-based Pangea DiamondFields plc, through its wholly owned subsidiary Dimbi Diamants SAU, explored for diamond at the Dimbi and the Etoile alluvial

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diamond concessions. Following the commissioning of a bulk sampling plant in January 2007, the company began a bulk sampling exercise at Dimbi, which was focused mainly around a 3-km radius from the plant and was concentrated mainly in the Mea River floodplain and the Akongo River. The objective of the company was to delineate sufficient ore resources at economic grades to process about 40,000 cubic meters per month of gravel for at least 5 years. More than 3,500 carats were recovered at Dimbi as of October 2008, but owing to market conditions and lower diamond prices during 2008, the company decided to place the Dimbi plant and equipment on care-and-maintenance status. Activities at the Etoile concession were also suspended pending the recovery of the diamond market (Pangea DiamondFields plc, 2009, p. 15).

Mineral Fuels and Related Materials

Uranium.—On August 1, 2008, Areva Group of France signed an agreement with the Government to mine uranium at Bakouma in eastern Central African Republic. The deal reportedly ended friction between Areva and the Government, which in 2006 had awarded the Bakouma mining rights to the British-Canadian company UraMin Inc. Areva bought out UraMin in July 2007 and thereby acquired a 90% working interest in 10 separate areas of uranium mineralization within the Bakouma prospect. Uranium deposits at Bakouma were mined to a limited extent during the 1960s and 1970s but not at a commercial scale. Areva planned to begin delivering uranium by 2010. Inferred mineral resources at Bakouma were estimated to be about 5.7 million metric tons at an average grade of 1.72% U (Ngoupana, 2008; Thompson Financial News Ltd., 2008; Areva Group, 2009, p. 87).

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CÔTE D'IVOIRE

Mineral commodities produced in Côte d'Ivoire included cement, clay, diamond, gold, gravel and crushed stone, manganese ore, natural gas, niobium (columbium) ore, crude petroleum and petroleum products, sand, sulfuric acid, and tantalum ore. Undeveloped mineral resources included bauxite, cobalt, copper, iron ore, nickel, and silica sand. On May 7, 2008, Côte d'Ivoire was accepted as a candidate country to join the Extractive Industries Transparency Initiative. The country had until May 8, 2010, to undertake validation (Extractive Industries Transparency Initiative, 2008).

On October 29, 2008, the United Nations Security Council renewed once again the ban on rough diamond exports that it had imposed on the country since 2002. The measure was to be reviewed on October 31, 2009. Presidential elections, which were originally to be held in November 2008, were postponed, and no new date was established as of yearend (United Nations Security Council, 2008; U.S. Department of State, 2009).

Production

Manganese ore production increased by 86.6% to 176,561 metric tons (t) in 2008 from a revised 94,618 t in 2007. Gold production increased by 238% to 4,205 kilograms (kg) from 1,243 kg as a result of the opening of the Angovia and the Bonikro gold mines. Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—During the second quarter of 2008, La Mancha Resources Inc., which held a 45.9% interest in the Ity gold mine, began an exploration campaign on the northeast portion of the Zia extension area, which is adjacent to the former Flotouo-Zia pit. Preliminary results from the exploration campaign and the prefeasibility study reportedly showed a positive economic potential for the area, which the company planned to develop beginning in 2013 (La Mancha Resources Inc., 2009, p. 35).

In June 2008, Lihir Gold Ltd. of Australia completed a merger with Equigold NL, thereby acquiring a 90% interest in Equigold's Bonikro gold project. The Bonikro gold project is located in south-central Côte d'Ivoire about 250 km northwest of the capital city of Abidjan. Equigold had discovered gold mineralization at Bonikro in 1996 and by May 2007 had begun the construction of a mine. First commercial production from the Bonikro open pit mine was achieved in October 2008 and by yearend, a total of about 1,150 kg (reported as 37,000 troy ounces) of gold had been produced. Annual gold production was expected to average about 3,700 kg (reported as 120,000 troy ounces) during the 8 years of projected mine life (Lihir Gold Ltd., 2009, p. 16-17).

Construction work was underway at London-based Randgold Resources Ltd. of the United Kingdom's Tongon project,

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which included the construction of key mine installations, such as housing, power and water supply, and administration and communication facilities. Engineering, construction, and civil earthworks contractors had also been appointed, and other contracts were being negotiated. The Tongon project is located within the company's Nielle exploration permit in northern Côte d'Ivoire about 55 km south of the border with Mali. The company planned to develop an open pit gold mine at Tongon with production capacity of about 9,000 kg/yr (reported as 290,000 troy ounces) during the first 2 years of operation and then an average of about 8,400 kg/yr (reported as 270,000 troy ounces) for the remainder of the mine's life, which was estimated to be 10 years. The Tongon Mine was scheduled to be commissioned in the fourth quarter of 2010. Randgold Resources held an 84% interest in the project (Randgold Resources Ltd., 2009, p. 14, 30-35).

The Angovia Mine, which is located about 40 km northwest of Yamoussoukro, poured its first gold in March 2008. Cluff Gold plc. of the United Kingdom (the company that operated the mine) estimated that production at Angovia would reach about 1,200 kg (reported as 40,000 troy ounces) in 2009 (Cluff Gold plc, 2008).

Iron Ore.—Tata Steel Group, through its subsidiary Tata Steel Côte d'Ivoire S.A., was awaiting Government approval to proceed with exploration activities at the Mount Nimba iron ore deposit. Upon approval of an exploration license, the company planned to invest more than $1 billion and to conduct a feasibility study in 2009. The iron ore mined was to be supplied to Tata Steel's subsidiary Corus Group, which had steel production facilities in the Netherlands and in the United Kingdom (Tata Steel Group, 2008a, 2008b, p. 86, 166).

Manganese.—Taurian Resources Private Ltd. continued to explore for manganese in the Zanzan region in northeastern Côte d'Ivoire. The company held two exploration licenses, one for the Bondouku area, which consisted of numerous hills containing manganese mineralization, and one for the Toumodi area, which consisted of two hills containing manganese mineralization. In 2008, Taurian announced that the Government had granted the company a special authorization to export 50,000 t of manganese ore from its Bondouku and Toumodi concessions during the exploration stage. The company used about 45,000 t of this amount during the year through its mining operations at Bondouku. Taurian submitted a feasibility report to the Government and was awaiting a mining permit for the development of the Bondouku deposits, which it expected to receive by mid-2009. To ensure that there was no stoppage of mining activities at Bondouku during the permitting period, the Government granted Taurian another special export permit for an additional 200,000 t. Mining operations at Dingbi and Kofu were expected to begin in June 2009 (Taurian Resources Private Ltd., 2008).

Industrial Minerals

Diamond.—Partnership Africa Canada, which is a nongovernmental organization, reported that a joint review mission conducted in April 2008 by a United Nations panel of experts on Côte d'Ivoire and the Kimberley Process revealed that diamond continued to be mined in areas that remained under the control of the rebel group Forces Nouvelles and indicated that although Côte d'Ivoire was under a United Nations embargo, diamond continued to be traded in the open market. The group of experts visited the diamond mining areas of Bobi, Korhogo, Seguela, and Tortiya. The number of people mining in these areas was estimated to be between 5,000 and 20,000 (Partnership Africa Canada, 2008a, 2008b, p. 20; United Nations Security Council, 2008).

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TOGO

Mineral commodities produced in Togo included cement, clinker, diamond, gold, limestone, and phosphate rock. Undeveloped mineral resources included bauxite, gypsum, iron ore, manganese, marble, rutile, and zinc.

Production

In 2008, diamond production decreased by 49% to 8,787 carats from 17,362 carats produced in 2007. Production of phosphate rock increased by about 12% to 842,000 t from 750,000 t in 2007. Data on mineral production are in table 1.

Structure of the Mineral Industry

At least one company, Lithic Metals and Energy Ltd., explored for chromite, nickel, uranium, and zinc in Togo in 2008. Table 2 is a list of major mineral industry facilities.

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Commodity Review

Metals

Lithic Metals and Energy Ltd. of Australia (LMEL), through its subsidiary Regent Resources Capital Corporation S.A.U., held several exploration licenses for three project areas in Togo that were prospective for chromite, nickel, uranium, and zinc. The three project areas were of the Haito, the Niamtougou-Kara, and the Pagala projects. The Haito project, which is located in southern Togo, consisted of five exploration licenses for an area of 1,000 square kilometers (km^2); the project had known nickel mineralization and historical chromite production as well as minor copper occurrences that had been identified by earlier Government-funded exploration and mapping programs. In September 2008, the company announced assay values of up to 6.38% nickel and 0.34% cobalt from test pits completed at the Kpote Hill prospect and nickel values of 1.04% nickel from test pits completed at the Mount Haito prospect. Chromite was mined at Mount Haito by a French company during the 1950s. Sampling of remnant chromite dumps and outcropping chromite material by LMEL returned values of up to 44% Cr_2O_3. The Pagala project, which is located about 250 km north of the capital city of Lome in central Togo, consisted of five exploration licenses for an area of 1,000 km^2. At Pagala, the company targeted known zinc mineralization, which had been identified previously by Anglo American plc of the United Kingdom and Bureau de Recherches Géologiques et Minières of France. Between the 1970s and the 1990s, marble, which was deemed suitable for the production of dolomitic quicklime, was also mined at Pagala. Phosphate rock occurrences had also been identified at Pagala. LMEL planned to compile and reinterpret all available data on Pagala, to conduct field validation test work, and to evaluate phosphate rock and marble occurrences. The Niamtougou-Kara project, which is located about 400 km from Lome in northern Togo, covered an area of 1,640 km^2. An exploration campaign conducted during the 1960s and 1970s discovered uranium in several target areas. LMEL completed an airborne geophysical survey of the project area in April 2008 and planned to conduct mapping, sampling, and drilling of targets (Lithic Metals and Energy Ltd., 2008a, p. 10-14; 2008b).

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TABLE 1

CENTRAL AFRICAN REPUBLIC, CÔTE D'IVOIRE, AND TOGO: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Country and commodity		2004	2005	2006	2007	2008
CENTRAL AFRICAN REPUBLIC[3]						
Clay		NA	NA	78,886 [4]	79,000	79,000
Diamond[5]	carats	350,000	383,300 [4]	419,528 [4]	467,711 [4]	377,209 [4]
Gold, mine output, Au content	kilograms	7	15 [4]	10 [4]	10	10
Limestone		NA	85,000 [4]	85,000 [4]	85,000	85,000
Sand and gravel		NA	NA	172,436 [4]	173,000	170,000
CÔTE D'IVOIRE[6]						
Cement		650,000	650,000	650,000	650,000	650,000
Columbium (niobium) and tantalum:						
Columbite	kilograms	130	130	130	130	130
Tantalite	do.	400	400	400	400	400
Diamond	carats	300,000	300,000	300,000	300,000	300,000
Gold, mine output, Au content[7]	kilograms	1,219 [4]	1,335 [4]	1,324 [4]	1,243 [4]	4,205 [4]
Gravel and crushed stone		659,097 [4]	660,000	660,000	660,000	660,000
Manganese ore, gross weight		--	--	56,829 [4]	94,618 [r, 4, 8]	176,561 [4, 8]
Natural gas	million cubic meters	2,000 [4]	2,200 [4]	2,200	1,574 [r, 4]	1,600
Petroleum:						
Crude	thousand 42-gallon barrels	8,125 [4]	14,574 [4]	21,955 [4]	17,727 [4]	22,000
Refinery products	do.	19,000	19,000	19,000	19,000	19,000
Sand		173,056 [4]	173,000	173,000	173,000	173,000
Sulfuric acid		3,000	3,000	3,000	3,000	3,000
TOGO[9]						
Cement:						
Clinker		1,200,000	1,200,000	1,200,000	1,200,000	1,200,000
Hydraulic[10]		800,000	800,000	800,000	800,000	800,000
Diamond	carats	123,000	41,000	28,176 [4]	17,362 [4]	8,787 [4]
Limestone		2,400,000	2,400,000	2,400,000	2,400,000	2,400,000
Phosphate rock, beneficiated product:						
Gross weight	thousand metric tons	1,115 [4]	1,350	1,650	750	842 [4]
P_2O_5 content	do.	418 [4]	481	590 [4]	270	303

[r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through October 6, 2009.

[3]In addition to the commodities listed, Central African Republic produced quartz crystals, but information is inadequate to make reliable estimates of output.

[4]Reported figure.

[5]Production is approximately 70% to 80% gem quality.

[6]In addition to the commodities listed, Côte d'Ivoire produced clay and crushed granite, but information is inadequate to make reliable estimates of output.

[7]Does not include production from artisanal mining.

[8]Based on reported manganese ore exports.

[9]Togo also presumably produced gold, but output is not reported, and available information is inadequate to make reliable estimates of output.

[10]Includes cement produced from imported clinker.

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TABLE 2
CÔTE D'IVOIRE AND TOGO: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
CÔTE D'IVOIRE				
Cement		Société des Ciments d'Abidjan	Abidjan plant	750,000.
Do.		Société de Ciments et Materiaux (Holcim Ltd.)	do.	800,000.
Do.		Société des Ciments du Sud-Ouest	San Pedro	100,000.
Gold	kilograms	Société des Mines d'Ity (La Mancha Resources Inc., 45.9%; Société pour le Développement Minier, 44.1%; Government 10%)	Ity Mine, 700 kilometers from Abidjan	1,900.
Do.	do.	Yaouré Mining SA (Cluff Gold plc, 90%, and Government, 10%)	Angovia Mine, 40 kilometers northwest of Yamoussoukro	1,240.
Do.	do.	Equigold Mines CISA (Lihir Gold Ltd., 90%, and Government, 10%)	Bonikro Mine, 250 kilometers northwest of Abidjan	3,700.
Manganese		Société pour le Developpement Minier	Pilot plant, eastern Bondoukou	NA.
Petroleum, crude	thousand 42-gallon barrels	Canadian Natural Resources Ltd., 57.61%; Svenska Petroleum Exploration AS, 27.39%; Société Nationale d'Operations Pétrilières de la Côte d'Ivoire (Petroci), 15%	Baobab oilfield, offshore	17,520.
Do.	do.	Canadian Natural Resources Ltd., 58.67%; Tullow Oil plc, 21.33%; Société Nationale d'Operations Pétrolières de la Côte d'Ivoire, 20%	East Espoir oilfield, offshore	6,700.
Petroleum products	42-gallon barrels per day	Société Ivorienne de Raffinage (Government, 100%)	Abidjan	65,000.
TOGO				
Cement[1]		Société de Ciments du Togo	Lome plant	800,000 cement.
Do.		West Africa Cement Co.	Tabligbo	1,000,000 cement; 1,200,000 clinker.
Limestone[1]		Ciments de l'Afrique de l'Ouest	do.	2,400,000.
Phosphate rock		International Fertilizer Group Togo	Akoumape and Hahotue	2,000,000.

Do., do. Ditto.
[1]Based on information available as of yearend 2005.

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The Mineral Industry of Chad

By Philip M. Mobbs

Hydrocarbons remained the leading segment of the economy of Chad. In 2008, Chad's oil revenue jumped by nearly 54% to $1.87 billion and accounted for about 80% of Government revenue. In 2008, income from crude oil again increased, despite the decline in output, owing to the dramatic rise in the average price of exported oil to $104.30 per barrel from $60.80 per barrel in 2007 (table 1; Banque des États de l'Afrique Centrale, 2009a, b; Esso Exploration and Production Chad, Inc., 2009, p. 73).

The Petroleum Revenue Management Law (law No. 001/PR/99 of 1999) and amendments, such as law No. 002/PR/06 of 2006, defined the allocation of petroleum revenues. Mining of solid minerals, which was a negligible contributor to the national economy, was regulated by the Mining Code (law No. 011/PR/1995 of 1995).

Most official international trade with landlocked Chad was channeled through seaports in Cameroon and Nigeria. Petroleum produced in the Doba Basin was exported by way of the Chad-Cameroon pipeline to an export terminal at Kribi, Cameroon.

Production

Production of crude oil far exceeded the output of the country's limited suite of other mineral commodities, which included clay, gold, lime, limestone, salt, sand, soda ash (natron), and stone. For the third year in a row, national oil production declined slightly. Estimates of Chad's mineral production are in table 1.

Structure of the Mineral Industry

The Ministère des Mines et de l'Énergie and the Ministère du Pétrole monitored the activity of various sectors of the mineral industry. Société des Hydrocarbures du Tchad S.A. was the national oil company.

Small-scale domestic mining operations produced most of the country's nonfuel minerals. International companies were involved in the exploration for and the production of crude oil and the exploration for uranium. Esso Exploration and Production Chad, Inc. (Esso Chad) and Tchad Oil Transportation Co. S.A. operated about 200 kilometers (km) of the 1,070-km crude oil pipeline that originated in Chad and ended at an offshore terminal in Cameroon.

Commodity Review

Potential mineral exploration activity was inhibited by armed factions that engaged in hostilities primarily in eastern Chad, and the February invasion of the capital disrupted exploration companies' office activity in N'Djamena. Field exploration activity also was inhibited in eastern Chad by social instability, which was associated with ongoing military action in the Darfur region of western Sudan.

Mineral Fuels and Related Materials

Petroleum.—Esso Chad reported that its oil output from Chad continued to decline to an average of 127,200 barrels per day (bbl/d) in 2008 from 143,600 bbl/d in 2007. The company drilled an additional 60 wells in its Doba Basin oilfields, started the second phase of a high-pressure water-injection project to maintain reservoir pressure, and continued stimulations of existing wells in 2008. Without the additional production wells and the reservoir pressure maintenance and the well stimulation programs, Esso Chad estimated that production would have dropped to about 56,000 bbl/d in 2008 (Esso Exploration and Production Chad, Inc., 2008. p. 8; 2009, p. 7-8).

CNPC International Ltd. of Chad, which was a subsidiary of China National Petroleum Corp., drilled successful exploration wells on the Baobab, the Kubla, the Mimosa, and the Ronier prospects in the Permit H concession. In October, CNPC (60% interest) and the Government (40% interest) began the initial stage of construction of a 53,000-bbl/d-capacity petroleum refinery near N'Djamena. Phase 1 of the project (which was a planned 21,000-bbl/d-capacity refinery) was expected to be completed in 2011 (Industrial Info Resources, 2008).

Uranium.—In 2007, UraMin Inc. of South Africa held the Fada Itou, the Madagzang, the Sodje Mbaye, and the Yedri Ténéré exploration permits. Areva Resources Southern Africa was formed after Areva NC of France acquired UraMin. Areva Resources Southern Africa subsequently focused its attention on exploration in the Central African Republic, Namibia, and South Africa. In March 2008, Signet Mining Services Ltd. of South Africa, acquired licenses to explore for uranium at Madagzang and Sodje Mbaye. Also in 2008, Brinkley Mining Plc acquired three exploration licenses but relinquished them in September after completing airborne and ground surveys.

Outlook

Esso Chad's production enhancement program that included new oil wells, a high-pressure water injection system, and workovers of existing oil wells have slowed the production decline observed since 2004. Development of CNPC International's Bongor Basin oil reservoirs would provide input feedstock for the proposed N'Djamena oil refinery, which would reduce Chad's reliance on imported refined petroleum products.

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TABLE 1
CHAD: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Aggregate, sand, and stone		300	300	300	300	300
Gold, mine output, Au content	kilograms	150	150	150	150	150
Petroleum, crude[4]	thousand 42-gallon barrels	61,400	63,300	55,900	52,400	49,400
Salt		9	10	10	10	10
Soda ash, natron		12	12	12	12	12

[1]Estimated data are rounded to no more than three significant digits.
[2]Table includes data available through May 18, 2009.
[3]In addition to the commodities listed, other industrial minerals and construction materials (clay, lime, and limestone) are produced, but information is inadequate to make reliable estimates of output.
[4]Reported figure. Production volume from the Doba Basin in Chad was metered on the floating storage-and-offloading vessel, which was located offshore Kribi, Cameroon.

TABLE 2
CHAD: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Artisanal placer operations	Mayo Dala Department	150
Petroleum, crude	million 42-gallon barrels	Esso Exploration and Production Chad, Inc. (Esso Chad) (Exxon Mobil Corp., 40%; Petronas Carigali Overseas Sdh. Bhd., 35%; Chevron Overseas Petroleum Inc., 25%)	Bolobo, Kome, Maikeri, Miandoum, Moundouli, and Nya Fields, Doba Basin	79
Salt		Various local operators	Various locations	10,000
Soda ash		do.	Lake Chad, near Liwa	12,000
do. Ditto.				

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The Mineral Industry of Congo (Brazzaville)

By Philip M. Mobbs

High international oil prices in early 2008 resulted in a significant boost to the economy of the Republic of the Congo, also known as Congo (Brazzaville). The petroleum sector output was estimated to account for about 94% of the country's exports, about 87% of Government revenues, and about 68% of the country's gross domestic product. In 2008, Congo (Brazzaville) ranked eighth among African crude oil producers (BP p.l.c., 2009, p. 8; International Monetary Fund, 2009, p. 17, 18).

Mining is regulated by the Code Minier (law No. 4-2005). The petroleum sector is regulated by the Code des Hydrocarbures (law No. 24-1994). Congo (Brazzaville) was a participant in the Kimberley Process Certification Scheme (Kimberley Process) and, in February, was accepted as a candidate country by the Extractive Industries Transparency Initiative.

Production

Most of Congo (Brazzaville)'s hydrocarbons were produced from offshore fields. Most of the natural gas produced was flared because of the lack of gas-gathering infrastructure.

Significant increases in diamond and liquid petroleum gas (butane and propane) output were posted in 2008. Official diamond production and trade had been proscribed between 2004 and November 2007 when Congo (Brazzaville) was readmitted as a participant in the Kimberley Process and allowed to resume trade of diamond with Kimberley Process participant nations (which accounted for about 98% of the international diamond trade). The notable decrease in refined petroleum product in 2008 was attributed to maintenance and renovation of the crude oil refinery of state-owned Congolaise de Raffinage (CORAF).

Structure of the Mineral Industry

The mineral sector is under the jurisdiction of the Ministère des Mines, des Industries Minières et de la Géologie. Most mining activity is artisanal. The Ministère des Hydrocarbures regulates the hydrocarbon sector. State-owned Société Nationale des Pétroles du Congo (SNPC) manages the Government's interest in petroleum and natural gas, and international oil companies operate many of the oilfields.

Commodity Review

Metals

The updated (2005) mining law and high international mineral prices in 2008 resulted in a surge in mineral exploration interest in Congo (Brazzaville). Century Aluminum Congo S.A., which was a subsidiary of Century Aluminum Co. of the United States, continued its evaluation of bauxite deposits. The Société de Recherche et d'Exploitation Minière, which was a subsidiary of Gerald Metals, Inc. of the United States, started exploration for copper, lead, and zinc, as did the local subsidiary of Sanu Resources Ltd. of Canada. Compagnie Minière du Chaillu, which was a subsidiary of Mexivada Mining Corp. of Canada, continued its exploration for diamond and gold. Companies that explored for iron ore included Congo Iron S.A., which was subsidiary of Sundance Resources Ltd. of Australia; Congo Mining Ltd., which was a subsidiary of Geominex Resources Ltd. of the United Kingdom; DMC Iron Congo S.A.R.L., which was subsidiary of DMC Mining Ltd. of Australia; IDG Resources, which was a subsidiary of Industrial Development Group of South Africa; and Mining Projects Development Congo S.A., which was a subsidiary of Mining Projects Development of the United Kingdom.

Magnesium.—In 2008, MagMetals Inc., which was a division of MagIndustries Corp. of Canada, acquired the rights to use Norsk Hydro ASA's electrolytic magnesium extraction technology at its planned 60,000-metric-ton-per-year (t/yr)-capacity magnesium smelter, which was to be built adjacent to the Kouilou fertilizer plant. MagMetals also acquired equipment from Hydro's Bécancour magnesium plant in Quebec, Canada, which was closed in 2007 (MagIndustries Corp., 2008a).

Industrial Minerals

Cement.—Société Nouvelle des Ciments du Congo at Loutete was unable to satisfy domestic demand for cement. In 2008, the Government contracted for the construction a second cement plant. The new 500,000-t/yr-capacity plant would be located at Madingou (AfricanEconomicOutlook.org, undated).

Potash.—MagMinerals Inc., which also was a division of MagIndustries, completed the feasibility study of the Kouilou potash mine in 2008 and subsequently was granted a 25-year potash mining license. The capital cost of the 600,000-t/yr-capacity solution-mining project was estimated to be $723 million. The mine was projected to produce a magnesium- and potassium-rich brine, which would be used to produce granular potash fertilizer. Congo Potash Co. of Canada acquired a research permit to explore for potash in the Tchizalamou area, which is located near MagMinerals' Kouilou project (MagIndustries Corp., 2008b).

Mineral Fuels

Petroleum.— The joint venture of Total Exploration & Production Congo (53.5%); Chevron Overseas (Congo) Ltd. (31.5%); and SNPC (15%) started production from the 90,000-barrel-per-day-capacity Moho-Bilondo field, which was Congo (Brazzaville)'s first deepwater oilfield. Crude oil from the field, which was located about 80 kilometers offshore, was piped back to the onshore Djeno terminal, and the natural gas was piped to the offshore Nkossa platform (Snieckus, 2008, p. 35).

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ENI SpA acquired Burren Energy PLC in 2008. Burren's assets in Congo (Brazzaville) included 30.6% interest in the onshore M'Boundi field, which had been held by its subsidiary Tacoma Resources Ltd., and interest in the Tchikatanga tar sands. Tullow Oil plc of the United Kingdom divested its 11% interest in the onshore M'Boundi field, which had been held by its subsidiary Energy Africa Congo Ltd., to Korean National Oil Co.

Outlook

The Government's proposed repaving of the highway from Brazzaville to Point Noire, the renovation of the Chemin de Fer Congo Océan rail line from Brazzaville to its coastal terminal at Point Noire, and DMC Mining's planned rehabilitation of the railroad from Mbinda to Dolisie (near Loubomo, where it would connect to the Chemin de Fer Congo Océan), are expected to significantly enhance the movement of ores, mineral-based products, and other bulk materials in southern Congo (Brazzaville).

The petroleum sector is expected to remain the cornerstone of the country's economy for the immediate future. Output from Total's offshore Moho-Bilondo field, which started production in 2008, is expected to account for nearly 30% of the country's crude oil output by 2010. Output from the deepwater Azurite prospect also is expected to increase national oil production significantly. CORAF's renovation would allow the refinery to process crude oil from the Moho-Bilondo field, which would reduce the country's dependence on imported refined petroleum products.

In addition to exploration activity in the petroleum sector, prospecting and reconnaissance-stage exploration continued for diamond and metal ores. The redevelopment of coastal potash deposits is expected to result in the resumption of potash production in 2012.

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TABLE 1

CONGO (BRAZZAVILLE): ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

Commodity[3]		2004	2005	2006	2007	2008
Cement	metric tons	--	100,000	100,000	100,000	100,000
Diamond	carats	50,000	-- [4]	-- [4]	22,000 [r, 5]	110,000 [5]
Gold, mine output, Au content	kilograms	160	120	100	100	100
Lime	metric tons	400	400	400	400	400
Liquid petroleum gas[6]	thousand 42-gallon barrels	919 [5]	766 [5]	2,960 [5]	1,016 [r, 5]	1,610 [5]
Petroleum:						
Crude	do.	82,069 [5]	92,550 [5]	93,261 [5]	81,700 [5]	85,037 [5]
Refined	do.	2,700	3,000	3,500	3,500	2,500

[r]Revised. do. Ditto. -- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through January 20, 2010.

[3]In addition to the commodities listed, crude construction materials (for example, clay, sand and gravel, and stone) were produced, but available information is inadequate to make reliable estimates of output. Natural gas is also produced, but output is flared, reinjected, or vented.

[4]No official diamond production was reported. Artisanal production and diamond exploration continued.

[5]Reported figure.

[6]Includes butane and propane.

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TABLE 2
CONGO (BRAZZAVILLE): STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	Major operating companies and and major equity owners	Location of main facilities	Annual capacity[e]
Cement metric tons	Société Nouvelle des Ciments du Congo (Société National Chinoise des Travaux des Ponts et Chaussées, 56%, and Government, 44%)	Loutete	250,000
Diamond carats	Artisanal production	Kouilou, Lekoumou, Likouala, Niari, and West Cuvette regions	50,000
Gold kilograms	do.	Various locations	100
Liquefied petroleum gas	Total Exploration & Production Congo, 51%; Chevron Overseas (Congo) Ltd., 20%; Société Nationale des Pétroles du Congo (SNPC), 15%; Energy Africa Congo Ltd., 4%	Nkossa field, offshore	3,000
Petroleum:			
Crude	Total Exploration & Production Congo, 53.5%; Chevron Overseas (Congo) Ltd., 31.5%; Société Nationale des Pétroles du Congo (SNPC), 15%	Moho-Bilondo field, offshore	32,000
Do.	Total Exploration & Production Congo, 51%; Chevron Overseas (Congo) Ltd., 20%; Société Nationale des Pétroles du Congo (SNPC), 15%; Energy Africa Congo Ltd., 4%	Nkossa field, offshore	25,000
Do.	Total Exploration & Production Congo, 65%, and Eni Congo S.A., 35%	Kombi, Likalala, Tchibeli, and Tchibouela fields offshore	25,000
Do.	Eni Congo S.A., 74%; Korea National Oil Co., 11%; Société Nationale des Pétroles du Congo (SNPC), 8.8%	M'Boundi field, onshore	20,000
Do.	Eni Congo S.A., 35.75%; Société Nationale des Pétroles du Congo (SNPC), 35%; Chevron Overseas (Congo) Ltd., 29.25%	Kitina field, offshore	15,000
Do.	Eni Congo S.A., 65%, and Total Exploration & Production Congo, 35%	Zatchi field, offshore	12,000
Do.	Total Exploration & Production Congo, 55.25%; Eni Congo S.A., 29.75%; Société Nationale des Pétroles du Congo (SNPC), 15%	Sendji and Yanga fields, offshore	9,500
Do.	Eni Congo S.A., 65%, and Société Nationale des Pétroles du Congo (SNPC), 35%	Djambala, Foukanda, and Mwafi fields, offshore	7,300
Do.	Congorep [Perenco Group, 51%, and Société Nationale des Pétroles du Congo (SNPC), 49%]	Emeraude and Yombo fields, offshore	6,500
Do.	Likouala S.A., 65%, and Eni Congo S.A., 35%	Likouala field, offshore	3,800
Do.	CMS NOMECO Congo [Société Nationale de Recherche et d'Exploration Pétrolière (SNPC), 50%; Perenco Group, 25%; Nuevo Congo Co., 18.75%; Kuwait Foreign Petroleum Exploration Co. (K.S.C.), 6.25%]	Yombo field, offshore	3,600
Do.	Total Exploration & Production Congo, 65%, and Eni Congo S.A., 35%	Tchendo field, offshore	3,000
Do.	Eni Congo S.A.	Kouakouala field, onshore	500
Do.	do.	Ikalou-Ikalou Sud field	NA
Do.	Prestoil Kouilou, 45%; Société Nationale des Pétroles du Congo (SNPC), 35%; Zetah Maurel & Prom Congo S.A., 20%	Tilapia field, offshore	100
Do.	Société Africaine Oil Corp.	Pointe-Indienne field, onshore	50
Refined product	Congolaise de Raffinage (CORAF) [Société Nationale des Pétroles du Congo (SNPC), 100%]	Pointe Noire	7,600

[e]Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

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The Mineral Industry of Congo (Kinshasa)

By Thomas R. Yager

The Democratic Republic of the Congo [Congo (Kinshasa)] played a globally significant role in the world's production of cobalt and diamond. In 2008, the country's share of the world's cobalt production amounted to 45%; industrial diamond, 30%; gem-quality diamond, 6%; and copper, 2%. Congo (Kinshasa) accounted for about 48% of the world's cobalt reserves. Copper and crude petroleum production also played a significant role in the domestic economy. The country was not a globally significant consumer of minerals or mineral fuels (Edelstein, 2009; Olson, 2009a, b; Shedd, 2009).

Minerals in National Economy

The mining and mineral processing sector accounted for an estimated 13.4% of the gross domestic product in 2008, and the manufacturing sector, 4%. The mining sector grew by 11.4% in 2008. In 2007 (the latest year for which data were available), between 500,000 and 1 million artisanal and small-scale miners were estimated to be involved in diamond production; employment in diamond trading amounted to about 100,000. Employment in diamond mining and trading declined substantially in late 2008 because of the worldwide economic crisis (Partnership Africa Canada, 2007; Africa Mining Intelligence, 2009a; Ames and others, 2010, p. 6-7).

Government Policies and Programs

The Parliament of Congo (Kinshasa) passed a mining code in July 2002 that replaced Ordinance No. 81-013 of April 2, 1981. The revised code promotes private sector development of the mining industry; the principal role of the Government is to promote and regulate the development of the industry. Mining rights are vested with the Government. Congo (Kinshasa) was a signatory to the Kimberley Process, which established a certification system in November 2002 to reduce the trade in conflict diamond.

Mining rights were often allocated to artisanal miners by unwritten local customs. In most areas of the country, local chiefs played the most important role in the allocation of mining rights. The mining code had no provisions for operation or ownership of artisanal mines. Local customs came into conflict with the mining code when the Government granted licenses to small-scale diamond mining companies for mines operated by artisanal miners in Kasai Orientale Province, particularly in the Tshikapa area (Partnership Africa Canada, 2007).

In May 2007, the Government initiated a review of 61 previously negotiated mining contracts. By November 2008, 14 of the contracts were cleared as acceptable, 26 required further negotiation, and 21 were ruled to be unacceptable in their current (2008) form. The rejected contracts could face cancellation. The newly appointed Government called for a swift conclusion to the process in November (Welch, 2008).

Production

In 2008, the production of refined copper in Congo (Kinshasa) increased by 621%; niobium (columbium), by an estimated 254%; refined cobalt, by 137%; mined copper, by an estimated 64%; tantalum, by an estimated 41%; tin, by an estimated 33%; and mined cobalt, by an estimated 23%. Silver mine production decreased by 55%; tungsten, by an estimated 41%; gold, by an estimated 35%; diamond, by 26%; and cement, by 22%. Copper smelter production ceased.

Structure of the Mineral Industry

La Générale des Carrières et des Mines (Gécamines), which was a state-owned company, produced cobalt and copper; other cobalt and copper mining companies were privately owned. The cement producers Cimenterie de Lukala and Interlacs were privately owned. The Government held an 80% share in the large-scale diamond producer Société Minière de Bakwanga (MIBA). Artisanal and small-scale miners accounted for most Congolese output of diamond, gold, niobium, tantalum, tin, and tungsten. Artisanal and small-scale miners also played a significant role in the country's cobalt mine production.

Mineral Trade

Exports were estimated to be about $6.59 billion in 2008, and imports, $6.71 billion. Cobalt accounted for 38% of total exports; copper, 35%; crude petroleum, 12%; and diamond, 11%. Other mineral exports included gold, niobium, tantalum, tin, tourmaline, and tungsten. The share of diamond in total exports declined from nearly 61% in 2003, and crude petroleum, from 19%. Most of the decline was attributable to increased production and prices for cobalt and copper; crude petroleum exports tripled in value from 2003 to 2008, and cobalt and copper exports increased at an even faster rate. Petroleum products accounted for nearly 12% of total imports in 2008 (Ames and others, 2010, p. 29-30).

Commodity Review

Metals

Aluminum.—BHP Billiton Ltd. of Australia was engaged in a feasibility study of a new aluminum smelter in Bas-Congo Province. The proposed smelter would have a capacity of 800,000 metric tons per year (t/yr) in its first phase and would consume electricity produced from about 2,000 megawatts (MW) of installed capacity at the proposed Inga 3 hydroelectric power station on the Congo River. The feasibility study was expected to be completed in 2009. Depending on the results of the study and the development of Inga 3, aluminum production could start in 2014 or 2015. The estimated cost of the project was $3 billion (Mining Review Africa, 2007a).

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Cobalt and Copper.—First Quantum Minerals Ltd. of Canada produced copper ore from the Lonshi Mine; the company shipped its ore across the border with Zambia to the Bwana Mkubwa solvent extraction-electrowinning (SX/EW) facility. Reserves at the Lonshi Mine were depleted in the third quarter of 2008 (First Quantum Minerals Ltd., 2009, p. 18, 33).

In November 2007, First Quantum started production at the Frontier Mine and output amounted to 8,712 metric tons (t) of copper for that year. In 2008, production at the Frontier Mine was 80,177 t. Production in 2008 was limited by heavy rains early in the year, but the recovery rate increased during the year. Production was expected to increase to 98,000 t in 2009 and to an average of 103,000 t/yr of copper from 2010 to 2013 (First Quantum Minerals Ltd., 2009, p. 18, 28-29, 32).

By the end of 2008, First Quantum had completed 47% of the Kolwezi tailings project. Production was expected to start at the company's mine and SX/EW plant in the third quarter of 2010 at an initial rate of 35,000 t/yr of refined copper and 7,000 t/yr of cobalt hydroxide. First Quantum planned to increase production to an average of 70,000 t/yr of refined copper from 2011 to 2013; the life of the project was estimated to be 22 years with production at 70,000 t/yr. The cost of the expansion was estimated to be $40 million. First Quantum also planned to complete a study of the development of a cobalt refining plant in the first quarter of 2009 (First Quantum Minerals Ltd., 2009, p. 25, 29).

Anvil Mining Ltd. of Australia operated the Dikulushi open pit copper-silver mine, which is located near Lake Mweru in Katanga Province. The company exported copper concentrates from the Dikulushi Mine to Namibia for smelting. Anvil produced 11,047 t of copper in 2008 compared with 24,561 t in 2007; silver production decreased to 34,083 kilograms (kg) from 76,242 kg. Ore grades and recovery rates decreased in 2008 because of the shift from open pit mining to underground mining. In the fourth quarter of 2008, Dikilushi was shut down and placed on care-and-maintenance status; the mine was subeconomic at world copper prices of $1.40 per pound (Metal Bulletin, 2008; Anvil Mining Ltd., 2009, p. 14-15).

Anvil was engaged in a joint venture with DeMoura Enterprises and Gécamines to produce copper at the Mutoshi Mine (formerly known as the Kulu Mine). In 2008, production at Mutoshi declined to 7,448 t of copper from 10,066 t in 2007. Production was limited by lower ore grades and recovery rates. In November, the Mutoshi Mine was shut down (Anvil Mining Ltd., 2009, p. 15-16).

In 2008, Anvil produced 22,858 t of copper at the Kinsevere Mine compared with 13,006 t in 2007. In August, Anvil completed construction of an electric arc furnace at Kinsevere for the production of blister copper ingots with a grade of 92% copper. Blister copper production amounted to 820 t in 2008. Mining operations were suspended at Kinsevere in November. Anvil planned to make a decision on continuing blister copper production in the first quarter of 2009. If blister copper production were to continue, Anvil could produce at a rate of 5,100 t/yr from stockpiles (Anvil Mining Ltd., 2009, p. 15, 20-21).

Anvil completed nearly 40% of the construction on the second stage of the Kinsevere project in 2008. The company planned to build an SX/EW plant with a capacity of 60,000 t/yr of refined copper. In the fourth quarter of 2008, Anvil halted work on the plant because of the worldwide economic crisis. The capital costs of the second stage were estimated to be $380 million, of which $180 million was already spent. Anvil was searching for financing for the remaining $200 million in capital costs; the company hoped to complete construction in the second half of 2010 (Metal Bulletin, 2008; Anvil Mining Ltd., 2009, p. 3, 8).

Ruashi Mining SPRL (Metorex Ltd. of South Africa, 80%) produced cobalt and copper from tailings near the Ruashi Mine. In 2008, copper production from the tailings amounted to 9,175 t, and cobalt production, 388 t. The company's copper and cobalt production amounted to 8,971 t and 391 t, respectively, in 2007. Ruashi Mining started the second phase of the project in the second half of 2008, which involved mining the Ruashi ore body. Refined copper output from the Ruashi ore body that was produced at a new SX/EW plant amounted to 2,215 t. The company planned to produce at the SX/EW plant's full capacity of 45,000 t/yr of refined copper and 3,500 t/yr of cobalt hydroxide by December 2009. Capital costs of the second phase of the project were estimated to be $335 million (Metorex Ltd., 2008, p. 20-22; 2009).

At the beginning of 2008, Nikanor plc operated the Kananga and the Tilwezembe Mines. In 2008, production at Kananga and Tilwezembe amounted to 4,489 t of copper and 1,776 t of cobalt. Katanga Mining Ltd. of Canada merged with Nikanor in January. Mining operations were suspended at Tilwezembe in November because of declining cobalt and copper prices (Katanga Mining Ltd., 2009, p. 8, 36).

Katanga started copper mining at the KTO and T17 Mines in the first half of 2007; the company also reopened the Luilu refinery in December 2007. In 2008, production amounted to 26,611 t of refined copper and 749 t of cobalt metal. The combined mining operations of Katanga and Nikanor were expected to produce 45,500 t of refined copper and 4,000 t of cobalt metal in 2009. Katanga planned to increase capacity at Luilu to 70,000 t/yr of copper by mid-2009. From 2011 to 2013, Katanga planned further capacity increases at Luilu to 150,000 t/yr of copper. By 2015, a new SX/EW plant was expected to increase capacity to 310,000 t/yr of refined copper and 30,000 t/yr of refined cobalt and cobalt salt. Capacity increases after 2009 depended on securing additional financing (Katanga Mining Ltd., 2009, p. 28, 36).

Copper Resources Corp. (CRC) of Australia (Metorex, 50%) and its joint-venture partners planned to reopen the Kinsenda Mine by May 2009 and produce 35,000 t/yr of copper in concentrate. The capital costs of the project were estimated to be $93 million. The life of the mine was expected to be 13 years (Mining Review Africa, 2007b; Arenson, 2008).

Gécamines produced 26,051 t of copper and 690 t of cobalt in 2008. The company's production was constrained by aging equipment; a lack of investment, fuel, and spare parts; and poor infrastructure. Gécamines' joint ventures included its partnerships with Enterprise Generale Malta Forrest SPRL to produce cobalt and copper at the Luiswishi open pit mine and La Société pour le Traitement du Terril de Lubumbashi's (STL) tailings treatment plant in Lubumbashi. In 2008, the production of copper at Luiswishi increased to 11,204 t from about 10,000 t in 2007, and cobalt production decreased to 2,991 t

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from about 4,500 t. Starting in late 2008, the Luiswishi Mine was expected to be temporarily shut down; plans to build a new hydrometallurgical plant at Luiswishi were likely to continue in 2009. The plant's estimated costs were $165 million. Cobalt and copper output at STL remained nearly unchanged at 5,545 t and 3,113 t, respectively (George Forrest International S.A., 2008: Africa Mining Intelligence, 2009b; La Générale des Carrières et des Mines, 2009).

Chemaf SPRL started the production of refined copper at the Etoile Mine in 2007; the mine opened in 2005. Cathode production increased to 11,353 t in 2008 from 1,063 t in 2007; copper carbonate production amounted to 5,344 t in 2007. Cobalt production decreased to 2,402 t in 2008 from 2,599 t in 2007. By the end of 2009, Chemaf planned to commission a new 6,000-t/yr-capacity SX/EW plant to produce refined cobalt (Chemaf SPRL, 2009).

Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom started operations at its Luita SX/EW plant near Lubumbashi in 2007. The Luita plant was supplied by mines in the 467 and 469 concessions. In 2008, CAMEC produced 10,091 t of refined copper and 3,703 t of cobalt in concentrate compared with 4,948 t of copper and 699 t of cobalt in 2007. The company planned to increase capacity to 30,000 t/yr of refined copper and 8,000 t/yr of contained cobalt by March 2009, and 100,000 t/yr of copper and 12,000 t/yr of cobalt by March 2011. In November 2008, CAMEC shut down its mining operations; plans to restart mining and produce at the expanded capacity of 30,000 t/yr in the first quarter of 2009 depended on world cobalt market conditions (Central African Mining and Exploration Company plc, 2008, p. 14, 21; Mukumbira and Harrison, 2008).

TEAL Exploration & Mining Inc. of Canada and Gécamines started mining operations at the Luputo property in May 2007. In mid-2008, resources at Luputo were estimated to be 23.3 million metric tons (Mt) at a grade of 2.3% copper. Copper production was expected to be 8,500 t in concentrate in 2008; TEAL was engaged in a feasibility study of increasing copper production to 40,000 t/yr. By the fourth quarter of 2008, output had declined by 83% compared with that of the second quarter of 2008 (Arenson, 2008; TEAL Exploration & Mining Inc., 2008).

Mining at the Tenke Fungurume project was expected to start in the second half of 2009; output was planned to be 115,000 t/yr of refined copper and 8,000 t/yr of cobalt in metal and cobalt hydroxide in the first phase of the project. In 2008, the estimate of the project's capital costs was revised to about $1.9 billion from $900 million. Tenke Fungurume was a joint venture of Freeport McMoran Copper & Gold Inc. of the United States (57.75%), Lundin Mining Corp. of Canada (24.75%), and Gécamines (17.5%) (Arenson, 2008).

Africo Resources Ltd. of Canada planned to produce about 16,400 t/yr of copper and 3,800 t/yr of cobalt in concentrate at the new Kalukundi open pit mine starting in 2010. The capital costs of the project were estimated to be $163 million. Reserves were estimated to be 7.8 Mt at a grade of 2.44% copper and 0.69% cobalt. The life of the mine was expected to be 10 years (African Mining, 2007; Arenson, 2008).

Gold.—Artisanal and small-scale miners produced gold in the Ituri District of Orientale Province, Nord-Kivu Province, and Sud-Kivu Province in eastern Congo (Kinshasa). Most gold exports were undeclared; reported gold exports from Sud-Kivu Province amounted to about 240 kilograms per year (kg/yr) (Global Witness, 2009, p. 52).

Gold mines in the Fizi, the Kalehe, and the Mwenga Territories in Sud-Kivu Province were reportedly under the control of the Forces Démocratiques pour la Libération du Rwanda (FDLR). Illegal taxation of artisanal gold mining accounted for an estimated 75% of the FDLR's revenues. Congolese military forces took control of the Mukungwe Mines in Sud-Kivu in March 2008 in response to civil unrest related to an ownership dispute. The Mufa Mine at Tubimbi in Sud-Kivu was also controlled by Congolese military forces. Gold produced in mines in the southern part of Sud-Kivu was exported to Burundi across Lake Tanganyika (Garrett and Mitchell, 2009, p. 9; Global Witness, 2009, p. 33-35, 40-41, 73).

In July 2008, Banro Corp. of Canada completed its prefeasibility study of developing a new mine at Twangiza in Sud-Kivu Province. Banro initiated a full feasibility study in July. Depending on the results of the study, the company planned to produce an average of 10,700 kg/yr of gold during the first 3 years of mining at Twangiza and an average of 7,300 kg/yr during the first 7 years of mining. Reserves were estimated to be 48.9 Mt at a grade of 2.1 grams per metric ton (g/t) gold. The life of the mine was expected to be 12 years. Initial capital costs at Twangiza were estimated to be $541 million. Banro planned to complete a prefeasibility study at Namoya and a scoping study at Kamituga in 2009 (Mining Journal, 2008).

Moto Goldmines Ltd. of Australia and its joint-venture partners were considering the development of a new mine at the Moto project in the Ituri District of Orientale Province. According to the feasibility study of an open pit mine completed in December 2007, gold production would amount to an average of 12,400 kg/yr. Capital and infrastructure costs, which included a new 24-MW hydroelectric power station, were estimated to be $483 million. Reserves were estimated to be 37.8 Mt at a grade of 3.2 g/t gold. Moto planned to complete a feasibility study of an underground mine in the first quarter of 2009 (Moto Goldmines Ltd., 2009).

TransAfrika Resources Ltd. of Mauritius started soil sampling at EP6062 in Sud-Kivu Province in the second half of 2008; the company planned further exploration after the end of the rainy season in May 2009. AngloGold Ashanti Ltd. of South Africa explored at Mongbwalu in Orientale Province. In November 2008, the company suspended its exploration activities in Congo (Kinshasa) because of fighting between Government and rebel forces (Welch, 2008).

Niobium and Tantalum.—The Lueshe pyrochlore mine, which accounted for a majority of domestic niobium production between 2000 and 2003, reportedly reopened in 2008. Pyrochlore was shipped to Goma for export in late 2008. The Government blocked exports because of the continuing legal dispute concerning ownership of Lueshe that caused the mine to close in 2004 (Global Witness, 2009, p. 21).

Mwangachuchu Hizi International and other mining companies produced columbite-tantalite at Bibatama in Nord-Kivu Province using labor-intensive methods. The Congres National pour la

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Défense du Peuple (CNDP) reportedly obtained revenue from the illegal taxation of mining operations at Bibatama. About 15% of the CNDP's revenues were estimated to be attributable to mineral taxation and trading. The FDLR and Congolese military forces also reportedly obtained revenue from the illegal taxation of columbite-tantalite mining operations near Shabunda in Sud-Kivu Province (Spittaels and Hilgert, 2008, p. 24-25, 33-34; Garrett and Mitchell, 2009, p. 9; Global Witness, 2009, p. 40-41).

Exports of columbite-tantalite from Nord-Kivu and Sud-Kivu Provinces amounted to about 380 t in 2008 compared with 267 t in 2007. In the first 11 months of 2008, Sud-Kivu accounted for 84% of columbite-tantalite exports, and Nord-Kivu, 16% (Garrett and Mitchell, 2009, p. 31).

Tin.—Artisanal and small-scale miners produced cassiterite in Katanga, Maniema, Nord-Kivu, and Sud-Kivu Provinces. The Bisie Mines in the Walikale Territory in Nord-Kivu were the largest Congolese cassiterite mines; production was between 9,600 and 12,000 t/yr. The 85th Brigade of the Congolese military forces, which was not integrated into the unified national Congolese military forces, controlled the Bisie Mines. An estimated 95% of the 85th Brigade's revenues were obtained from the illegal taxation and trade of minerals. Kivu Resources Ltd. of South Africa held the mining rights for the Bisie Mines. The company planned to spend $28 million on the development of large-scale mining at Bisie. In October 2008, Kivu Resources declared force majeure at Bisie because of the 85th Brigade's control of the mines (Mukumbira, 2008; Garrett and Mitchell, 2009, p. 6; Global Witness, 2009, p. 27-30).

Cassiterite mines near Shabunda produced at least 840 t/yr, from which the FDLR and Congolese military forces reportedly obtained revenue from illegal taxation. The FDLR also controlled cassiterite mines in Walikale Territory and in Kalehe and Mwenga Territories in Sud-Kivu Province. The Karhembu Mine near the town of Tubimbi and the Lemera Mines in Sud-Kivu Province were controlled by Congolese military forces (Spittaels and Hilgert, 2008, p. 33-34; Global Witness, 2009, p. 33, 36, 40-42).

Other significant artisanal mining areas included Kasese and Kalima in Maniema Province and Kamituga in Sud-Kivu Province. Cassiterite production from Maniema Province was at least 1,639 t in 2007 (Garrett and Mitchell, 2009, p. 29).

Congolese exports of cassiterite from Nord-Kivu and Sud-Kivu Provinces amounted to about 18,200 t in 2008 compared with 13,656 t in 2007. In Goma, such companies as Mining and Processing Congo (MPC) (a subsidiary of Kivu Resources) and Society for Mining Development (Sodexmines) (a subsidiary of Elwyn Blattner Group of the United States) processed cassiterite concentrates to a tin content of 65% before export. In the first 11 months of 2008, about 75% of cassiterite exports was shipped from Nord-Kivu, and 25%, from Sud-Kivu. Belgium received 62% of Congolese cassiterite exports in 2007; Thailand, 14%; and the United Kingdom, 11% (Garrett and Mitchell, 2009, p. 29, 31; Global Witness, 2009, p. 60).

Tungsten.—More than 1,000 artisanal miners produced wolframite at Kamole in Sud-Kivu Province; the Kamole Mine was reportedly controlled by Congolese military forces. Wolframite was also mined in Nord-Kivu Province. Congolese wolframite exports from Nord-Kivu and Sud-Kivu Provinces amounted to about 650 t in 2008 compared with 1,095 t in 2007. In the first 11 months of 2008, about 76% of exports was shipped from Nord-Kivu, and 24%, from Sud-Kivu. In 2007, Belgium received about 63% of wolframite exports; the United Kingdom, 10%; and the Netherlands, 8% (Spittaels and Hilgert, 2008, p. 34; Garrett and Mitchell, 2009, p. 31; Global Witness, 2009, p. 60).

Industrial Minerals

Diamond.—MIBA mined mostly industrial and near-gem-quality diamond at Mbuji-Mayi in Kasai-Oriental Province; production amounted to about 100,000 carats per month in 2008. The company planned to increase production to 200,000 carats per month. In September 2008, MIBA was granted $140 million in financing by the Industrial Development Corp. of South Africa and the Development Bank of Southern Africa. MIBA needed $25 million to rehabilitate its hydroelectric plants that were operating at 25% of capacity and an additional $100 million to build a new hyrdroelectric plant. The company's diesel generators were incapable of supporting large-scale mining and were increasingly difficult to operate because of high fuel prices. MIBA's financial difficulties were exacerbated by declining diamond prices in the second half of 2008. In October, MIBA was forced to shut down operations because of labor disputes; workers were unpaid for 20 months because revenues were less than labor costs (Africa Mining Intelligence, 2008; Bavier, 2008).

Artisanal miners produced diamond at Aketi in Orientale Province; at Bakongo, Bakwachimuna, and Tshibue in Kasai-Oriental Province; at Tshikapa in Kasai-Occidental Province; and at various operations in Bandundu, Bas-Congo, Equateur, and Katanga Provinces. Artisanal diamond production declined to 20.1 million carats in 2008 from 27.2 million carats in 2007. In the fourth quarter of 2008, artisanal diamond production declined sharply; miners in the Mbuji-Mayi area sought employment in the agricultural sector after many diamond traders shut down operations. In addition to the worldwide economic crisis, artisanal diamond production was also constrained by the lack of mining skills and access to capital, the absence of cooperatives, and poor working conditions (Partnership Africa Canada, 2007; Africa Mining Intelligence, 2009a).

Global Diamond Resources plc (GDR) of the United Kingdom engaged in bulk sampling and trial mining at alluvial deposits on the Tshumbe River in 2008. By the end of 2010, GDR planned to start a mining operation that would produce between 150,000 and 200,000 carats per year. By the end of 2012, production could increase to a rate of about 600,000 carats per year. Capital expenditures were estimated to be $25 million (Global Diamond Resources plc, 2008, p. 11, 13-14, 26, 29).

In March 2008, Pangea Diamondfields plc commissioned a new bulk sampling plant at its Longatshimo River project; the company recovered more than 1,000 carats of diamond by the end of June. Pangea also explored at the Tshikapa River project. Resources at Longatshimo River were estimated to be nearly 15.7 million cubic meters of gravel that contained 5.05 million carats, and at Tshikapa River, 16.5 million cubic meters of gravel that contained 3.35 million carats (Arenson, 2008; Pangea Diamondfields plc, 2008).

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In February 2008, BRC Diamond Corp. of Canada merged with Diamond Core Ltd. of South Africa to form BRC DiamondCore Ltd. In June, BRC formed a joint venture with Rio Tinto Group of Australia to explore for diamond at five of BRC's projects in Equateur and Orientale Provinces; the companies engaged in stream sampling. BRC also explored at its Candore East, Kwango River, Lubao, and Tshikapa projects. In November, BRC announced plans to engage in bulk sampling at Kwango River in 2009 and to discontinue exploration at Lubao (Arenson, 2008; BRC DiamondCore Ltd., 2008).

De Beers Group of South Africa and Bugeco SA of Belgium (African Diamonds plc of the United Kingdom, 35.42%) were engaged in a joint venture to explore at Bugeco's properties in Kasai-Oriental Province. In November 2008, De Beers announced plans to withdraw from the joint venture because of the worldwide economic crisis and the small size and low grade of the kimberlites (African Diamonds plc, 2009, p. 3, 17-18).

Gem Diamonds Ltd. of the United Kingdom engaged in dredging and alluvial exploration at its Longatshimo, Lubembe, and Mbelenge properties in 2008, which are located on the Longatshimo, the Lubembe, and the Kasai Rivers, respectively. In November, Gem Diamonds suspended all dredging and alluvial exploration activities; the company planned to continue with kimberlitic exploration (Ryan, 2009).

Gravity Diamonds Ltd. of Australia and BHP Billiton explored at Gravity's Gunge, Luebo, Maniamuna, and Penge concessions on the Kasai Craton. In May 2007, Gravity was purchased by Mwana Africa plc of the United Kingdom. BHP Billiton and SouthernEra Diamonds Inc. of Canada were engaged in a joint venture to explore at 39 of SouthernEra's 56 permits in Kasai-Oriental Province. SouthernEra was purchased by Mwana in November 2007. In early December 2008, BHP Billiton announced plans to withdraw from the agreement signed with SouthernEra by yearend and proposed to terminate the agreement signed with Gravity. Mwana subsequently suspended its diamond exploration activities in Congo (Kinshasa) (Jessop, 2008).

Mineral Fuels

Petroleum.—In April 2008, Soco International plc of the United Kingdom's production-sharing contract for the Nganzi Block became effective. Soco planned to conduct a seismic survey at Nganzi. In May, Dominion Petroleum Ltd. of Bermuda signed an agreement to explore at Block 5, which included areas on and near Lake Edward on the border with Uganda. Tullow Oil plc of the United Kingdom held Block 1, which included areas on and near Lake Albert. The company's exploration rights were withdrawn by the Government in 2008 because of alleged contract irregularities (Petroleum Economist, 2008; Irish Times, 2009).

Outlook

Cobalt and copper output in Congo (Kinshasa) is expected to increase substantially in the near future. The closing of the Dikulushi, the Kinsevere, and the Mutoshi Mines because of the worldwide economic crisis is likely to be more than offset by the opening of the Kalukundi and the Tenke Fungurume Mines and increased production from the Frontier, the KTO, the Ruashi, and the T17 Mines. The development of these projects depends heavily upon political and economic stability and favorable conditions in world markets. The outlook for gold, niobium, tantalum, tin, and tungsten is particularly dependent upon political stability because of continued civil unrest in eastern Congo (Kinshasa) and upon international concerns about the reported use of minerals to finance military operations.

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TABLE 1

CONGO (KINSHASA): PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
METALS						
Cobalt:						
Mine output, Co content[e, 3]		20,200	24,500	27,100	25,300	31,000
Metal, Co content[4]		735	600	550	606	1,439 [5]
Copper:						
Mine output, Cu content		73,000	97,000	142,000 [r]	148,000 [e]	243,000
Smelter, electrowon (low grade)		20,000	10,000 [r]	10,000 [r]	1,800 [r]	-- [5]
Refined		--	--	--	6,351 [r]	45,781 [5]
Germanium	kilograms	2,500	2,500	2,500	2,500	2,500
Gold, mine output, Au content[e]	do.	6,300 [r]	7,200 [r]	10,300 [r]	5,100 [r]	3,300
Niobium (columbium) and tantalum:						
Columbite-tantalite concentrate:[6]						
Gross weight		74	124	52	267 [r]	380
Nb content[e]		17	28	12	61 [r]	86
Ta content[e]		20	33	14	71 [r]	100
Pyrochlore concentrate:						
Gross weight		--	--	--	--	270
Nb content		--	--	--	--	130
Silver, mine output, Ag content	kilograms	32,953	53,553	67,633	76,242	34,083 [5]
Steel, crude		145,000	110,000	104,000	110,000 [r]	113,000 [5]
Tin, mine output, concentrate:[6]						
Gross weight		7,564	6,748	5,878	13,656 [r]	18,200
Sn content[e]		4,900	4,400	3,800	8,900 [r]	11,800
Tungsten, mine output, concentrate:[6]						
Gross weight		42	342	975	1,095 [r]	650
W content[e]		22 [r]	180	500	580 [r]	340
Zinc, mine output, Zn content		8,027	7,588	16,831	18,500	18,000
INDUSTRIAL MINERALS						
Cement, hydraulic		402,500	511,000	519,233 [r]	530,196 [r]	411,000 [5]
Diamond:[7]						
Artisanal	thousand carats	21,646	26,839	26,034 [r]	27,223 [r]	20,146 [5]
Large scale	do.	7,870	8,368	2,914 [r]	1,042 [r]	801 [5]
Total	do.	29,516	35,207	28,948 [r]	28,265 [r]	20,947 [5]
Lime[e]		25,000	25,000	25,000	25,000	25,000
Stone, crushed		205,000	210,000	217,000	230,000 [r]	237,000 [5]
Sulfuric acid[e]		15,000	15,000	15,000	15,000	15,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		108,000 [r]	120,000 [r]	124,000 [r]	128,000 [r]	116,000 [5]
Petroleum, crude	thousand 42-gallon barrels	10,100	9,000	9,009 [r]	8,816 [r]	8,000 [5]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through January 26, 2010.

[2]In addition to the commodities listed, tourmaline and crude construction materials, including brick clay, are produced, but available information is inadequate to make reliable estimates of output.

[3]Includes mine production and reprocessed tailings.

[4]Salable refined production only; excludes white alloy and matte.

[5]Reported data.

[6]Reported exports from Nord-Kivu and Sud-Kivu Provinces.

[7]An estimated 20% of total diamond is gem quality; the majority of production is from artisanal mining.

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TABLE 2
CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Cimenterie de Lukala [Enterprise Malta Forrest SPRL (EGMF), 80%]	Lukala plant near Kinshasa	360,000.
Do.	Interlacs [Enterprise Malta Forrest SPRL (EGMF), 98.7%]	Kabimba plant near Lubumbashi	50,000.
Do.	do.	Katana plant in Sud-Kivu Province[1]	NA.
Do.	Cimenterie Nationale SARL	Kimpese plant, 40 kilometers south of Kinshasa	318,000.
Do.	Cemenkat [Enterprise Malta Forrest SPRL (EGMF), and La Générale des Carrières et des Mines (Gécamines)]	Lubudi plant, between Likasi and Kolwezi, Katanga Province	200,000.
Coal	La Générale des Carrières et des Mines (Gécamines)	Luena Mine	800,000 bituminous.
Copper and cobalt:			
Mine	do.	Kamfundwa Mine	400,000 copper in ore; 48,000 cobalt in ore.
Do.	do.	Kamoya Central Mine	79,000 copper in ore; 7,000 cobalt in ore.
Do.	do.	Kamoya South Mine	36,000 copper in ore; 11,000 cobalt in ore.
Do.	do.	Shangalowe Mine	NA.
Do.	do.	Kambove concentrator	700,000 concentrates; 130,000[e] copper; 39,000[e] cobalt.
Do.	First Quantum Minerals Ltd.	Frontier Mine	84,000 copper.
Do.	do.	Lonshi Mine in Katanga Province	50,000 copper.
Do.	Katanga Mining Ltd.	KTO and T17 Mines	46,000[e] copper; 4,000[e] cobalt.
Do.	do.	Kananga Mine	14,000[e] copper in ore; 7,000[e] cobalt in ore.
Do.	do.	Tilwezembe Mine[1]	13,000[e] copper in ore; 4,000[e] cobalt in ore.
Do.	Anvil Mining Ltd.	Kinsevere Mine[1]	26,000 copper.
Do.	do.	Dikulushi Mine[1]	20,000 copper.
Do.	do.	Mutoshi Mine[1]	16,500 copper.
Do.	Central African Mining and Exploration Company plc (CAMEC)	Kakanda concentrator[1]	60,000 copper; 5,000 cobalt.
Do.	Chemaf SPRL	Etoile Mine	16,000[e] copper in ore; 3,300[e] cobalt in ore.
Do.	Compagnie Minière du Sud Katanga [Enterprise Generale Malta Forrest SPRL (EGMF), 60%, and La Générale des Carrières et des Mines (Gécamines), 40%]	Luiswishi Mine near Lubumbashi[1]	12,000 copper; 4,500 cobalt.
Do.	Ruashi Mining SPRL (Metorex Ltd., 80%)	Ruashi tailings project	10,000 copper; 1,000 cobalt.
Do.	TEAL Exploration and Mining Inc.	Kalumines	10,000 copper.
Do.	La Société pour le Traitement du Terril de Lubumbashi (STL) [OM Group Inc., 55%; Enterprise Generale Malta Forrest SPRL (EGMF), 25%; La Générale des Carrières et des Mines (Gécamines), 20%]	Big Hill plant at Lubumbashi	2,500 copper; 5,000 cobalt.
Refined	Katanga Mining Ltd.	Luilu plant	46,000[e] copper; 4,000[e] cobalt.
Do.	La Générale des Carrières et des Mines (Gécamines)	Shituru plant	50,000 copper; 6,000 cobalt.
Do.	do.	Fonderie Electrique de Panda cobalt plant	1,200 cobalt.
Do.	Chemaf SPRL	Etoile plant	16,000 copper.
Do.	Central African Mining and Exploration Company plc (CAMEC)	Luita plant[1]	10,000 copper.

See footnotes at end of table.

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TABLE 2—Continued
CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Diamond	carats	Société Minière de Bakwanga (MIBA) [Government, 80%, and Sibeka Group (which was owned by Mwana Africa plc), 20%]	Mines at Mbuji Mayi in Kasai-Oriental Province[1]	10,000,000.
Do.	do.	Artisanal miners	Mines at Aketi in Orientale Province, at Bakongo, Bakwachimuna, and Tshibue in Kasai Oriental Province, at Tshikapa in Kasai Occidental Province, and at various sites in Bas-Congo, Bandundu, Equateur, and Katanga Provinces	27,000,000.[e]
Gold	kilograms	Artisanal miners	Mines at various sites in Ituri District	5,200.[e]
Do.	do.	Artisanal miners, Congolese military forces, and Forces Démocratiques pour la Libération du Rwanda, of which:	Includes in Sud-Kivu Province:	4,800.[e]
		Artisanal miners	Various sites	
		Congolese military forces	Mufa and Mukungwe Mines	
		Forces Démocratiques pour la Libération du Rwanda	Mines in Fizi, Kalehe, and Mwenga Territories	
Niobium (columbium) and tantalum		Mwangachuchu Hizi International	Bibatama in Nord-Kivu Province	120.
Do.		Artisanal and small-scale miners	Mines at Bibatama in Nord-Kivu Province and Shabunda in Sud-Kivu Province	NA.
Petroleum:				
Crude	thousand 42-gallon barrels	Perenco REP (subsidiary of Perenco plc) and Congolaise des Hydrocarbures	Kifuku, Kinkasi, Liawenda, Makelekese, Muanda, Nsiamfuma, and Tschiende onshore wells	5,480.
Do.	do.	Muanda International Oil Co. (subsidiary of Perenco plc), 50%; Teikoku Oil Co. Ltd., 32.3%; ODS Ltd., 17.7%	GCO, Libwa, Lubi, Mibale, Moko, Motoba, Mwambe, and Tshlala offshore wells	3,650.
Silver	kilograms	Anvil Mining Ltd.	Dikulushi Mine[1]	50,000.
Sulfuric acid		La Générale des Carrières et des Mines (Gécamines)	Sulfuric acid plants at Kolwezi and Shituru	NA.
Do.		Central African Mining and Exploration Company plc (CAMEC)	Plant at Kambove	7,200.
Tin		85th Brigade of the Congolese military forces	Bisie Mines in Nord-Kivu Province	12,000 cassiterite.
Do.		Artisanal miners	Kalima Mines in Maniema Province	1,200[e] cassiterite.
Do.		Artisanal miners, Forces Démocratiques pour la Libération du Rwanda, and Congolese military forces	Mines near Shabunda in Sud-Kivu Province	840[e] cassiterite.
Do.		Artisanal miners	Kasese Mines in Maniema Province	500[e] cassiterite.
Do.		Forces Démocratiques pour la Libération du Rwanda	Mines in Kalehe and Mwenga Territories in Sud-Kivu Province and in Walikale Territory in Nord-Kivu Province	NA.
Do.		Congolese military forces	Mines at Lemara and Tubimbi	NA.
Do.		Mining Processing Congo (MPC), Sodexmines, and other companies	Processing plants at Goma	14,000[e] cassiterite.
Tungsten		Congolese military forces and artisanal miners, of which:	Includes:	1,000[e] wolframite.
		Congolese military forces	Mines at Kamole in Sud-Kivu Province	
		Artisanal miners	Mines at various sites in Nord-Kivu and Sud-Kivu Provinces	
Zinc		La Société pour le Traitement du Terril de Lubumbashi	Big Hill plant at Lubumbashi	15,000 zinc in zinc oxide.
Do.		United Resources AG	Kipushi Mine[1]	NA.
Do.		La Générale des Carrières et des Mines (Gécamines)	Kolwezi zinc leach plant and refinery[1]	30,000.
Do.		do.	Kolwezi zinc smelter[1]	72,000.

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating at the end of 2008.

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THE MINERAL INDUSTRY OF DJIBOUTI

By Thomas R. Yager

In 2008, the small East African country of Djibouti was a producer of salt and such construction materials as basalt (table 1). Djibouti's production and consumption of minerals were not globally significant.

Production

Salt production started on a semi-industrial scale at Lake Assal in 1998. Production increased from 2004 to 2008 because of the resumption of demand from Ethiopia. Production had nearly ceased in 2004 because of a 53% tariff that Ethiopia imposed in October 2003 on salt imports from Djibouti.

Structure of the Mineral Industry

Salt production at Lake Assal was carried out by small privately owned companies. Small amounts of salt were also produced at Doraleh by artisanal miners.

Commodity Review

Metals

Gold.—In July 2008, JB Djibouti Mining Ltd. (a subsidiary of JB Group of India) was awarded exploration licenses for four sites in the Dikhil Region in southern Djibouti. JB Djibouti Mining would have exploration rights at the Asaleyta, the Garrabayis, the Hesdaba, and the V.GPS41 properties for 3 years (Indian Ocean Newsletter, 2008a).

Industrial Minerals

Salt.—Djibouti's salt production was limited by reliance on the Ethiopian market, the absence of reliable water and energy supplies, and an inadequate regulatory framework. Other constraints included poor working conditions and a lack of iodization machinery.

In March 2008, the Government approved a plan by Salt Investment SA [a joint venture of Emerging Capital Partners LLC (ECP) of the United States, Hardtechnologies Group of Spain, and Société d'Exploitation du Lac Assal] to mine salt on the shore of Lake Assal. In July, ECP purchased a controlling share in Salt Investment. Production by Salt Investment was expected to reach 4 million metric tons by 2012 compared with less than 90,000 metric tons in 2008 (Emerging Capital Partners LLC, 2008; Indian Ocean Newsletter, 2008b).

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TABLE 1
DJIBOUTI: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons)

Commodity[3]	2004	2005	2006	2007	2008
Salt:					
Industrial production	17,745 [4]	45,000 r	70,000 r	90,000 r	110,000
Artisanal production	8,400	8,400	8,400	8,400	8,400
Total	26,000	53,000 r	78,000 r	98,000 r	118,000

rRevised

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 28, 2009.

[3]In addition to the commodity listed, crude construction materials, including basalt, are produced, but available information is inadequate to make reliable estimates of output.

[4]Reported figure.

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TABLE 2
DJIBOUTI: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons)

Commodity	Major operating companies	Location of main facilities	Annual capacity[e, 1]
Salt	Salt Investment SA	Mines at Lake Assal	86,000
Do.	Société Sel de Djibouti	do.	52,000
Do.	Société du Lac	do.	42,000
Do.	Société Moussa Ali	do.	34,000
Do.	Société Saline de Djibouti	do.	21,000
Do.	Société Mont Goda	do.	18,000
Do.	Société Mahad	do.	13,000
Do.	Société Kalou	do.	11,000
Do.	Société Mont Garbi	do.	4,000
Do.	Artisanal miners	Mines at Doraleh	8,400

[e]Estimated. Do., do. Ditto.
[1]Capacity estimate based on maximum production in 1 year between 1999 and 2004 for all producers except for Salt Investments SA and artisanal miners.

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The Mineral Industry of Egypt

By Mowafa Taib

In Egypt in 2008, the main focus of the mining industry and of international investors was on the exploration for and production of gold, hydrocarbons, phosphate rock, and tantalum. Egypt was a significant producer of natural gas and petroleum. It produced such metals as aluminum, ferroalloys, iron and steel, iron ore, manganese, secondary copper, and titanium. The country also produced industrial minerals, including basalt, bentonite, cement, construction sand and gravel, dolomite, feldspar, granite, gypsum, kaolin, limestone, marble, phosphate rock, quartz, salt, sandstone, silica sand, talc, and vermiculite.

Minerals in the National Economy

The economic activity of the mineral industry (including gas and petroleum) accounted for 14.3% of Egypt's gross domestic product (GDP) at factor cost in fiscal year 2008-09[1] compared with 14.1% of the GDP in fiscal year 2007-08. Natural gas production accounted for 7.9% of the GDP; petroleum production, 6.0%; and production of nonfuel minerals, 0.4%. In fiscal year 2008-09, the value of the mining sector grew by 6.4% at fiscal year 2006-07 prices. Natural gas production, which increased by 6.9%, led the mineral sector's expansion followed by petroleum production, which increased by 5.9%, and nonfuel mineral production, which increased by 4.0%. Most of the increase in the production of natural gas was attributable to activity by private companies, which increased by 17.3% compared with a 5.0% increase in the economic activity of the state-owned natural gas sector (Central Bank of Egypt, 2009, p. 115).

Foreign direct investment (FDI) played an important role in Egypt's mineral industry in recent years. The flow of FDI to Egypt decreased by 38.7% to $12,836 million (or 4.3% of the GDP) in fiscal year 2008-09 from $17,802 million (or 8.1% of the GDP) in fiscal year 2007-08. However, the share the FDI received by the petroleum sector in fiscal year 2008-09 increased to 75.3% of the total FDI from 45.5% in fiscal year 2007-08, whereas the share of investment in the industrial sector decreased to 6.6% in fiscal year 2008-09 from 8.6% in fiscal year 2007-08 (Central Bank of Egypt, 2009, p. 82-83).

Government Policies and Programs

The Ministry of Petroleum and Mineral Resources was in charge of managing the mineral industry in Egypt. Following the restructuring of the Ministry in 2004, five independently managed entities operate under the Ministry of Petroleum. They are the Egyptian Mineral Resources Authority (EMRA), the Egyptian General Petroleum Corp. (EGPC), Egyptian Natural Gas Holding Co. (ENGHC), Ganoube El Wadi Holding Co. (Ganope), and the Egyptian Petrochemical Holdings Co. (Echem). The International Finance Corp. of the World Bank Group, which signed a technical cooperation agreement with the Ministry of Petroleum, which was represented by EMRA to conduct a mining policy reform project in 2007, completed the project in 2008. The project aimed to promote private investment in Egypt's mining sector and to rewrite the Mining and Petroleum Code law No. 66 of 1953. By yearend 2008, an updated draft of the law was waiting for Parliamentary and Presidential approval (International Finance Corp., 2007, 2008; Brigoren, 2009).

The Egyptian Mineral Resources Scientists Council of the Ministry of Petroleum developed a long-term mining strategy for the country. The national strategy was focused on developing the mineral resources of the Abu Tartur phosphate rock reserves, which are located in the western desert; the Al Wadi Al Gadid phosphate project, which is located in the southeastern part of the country; and the Sinai Peninsula. In 2008, the Ministry of Petroleum announced a new round of mining bids in Sinai; a bidding round for 12 petroleum exploration blocks in offshore and onshore areas; and the first round of petroleum exploration bids by Ganope (Ridley-Wordrich, 2008; Rigzone.com, 2008; Ministry of Petroleum and Mineral Resources, 2009).

In October, the Ministry of Trade and Industry (MTI) lifted the duties on cement and steel exports, which had been imposed in 2007, to ease the shortages in the supply of cement and steel in the domestic markets. The duties were about $15[2] per metric ton for cement and $33 per metric ton for steel. In July, the Government increased the minimum fine imposed for violating the country's antimonopoly law to $60,000 from $20,000 and the maximum fine to $60 million from $2 million (Capital Research, 2008, p. 34; Hasan and others, 2009, p. 34).

Production

The mineral commodities for which production increased in 2008 compared with that of 2007 included barite (production of which increased by 2,060%), dolomite (838%), construction sand and gravel (728%), granite (dimension stone) (125%), kaolin (58%), basalt (57%), phosphate rock (42%), quartz (39%), vermiculite (31%), and feldspar (25%). Among the metals, there were also notable decreases in the production of manganese metal (44%), iron oxides (33%), and iron ore (17%). The industrial minerals for which production decreased significantly included fluorspar (56%), gypsum (21%), and lime (18%). Data on Egypt's mineral production are in table 1.

Structure of the Mineral Industry

In 2008, 75 companies were working in mineral fuels exploration and production in Egypt; 50 of the companies were

[1]The fiscal year runs from the end of June in one year through the end of June in the following year.

[2]Where necessary, values have been converted from Egyptian pounds (EGP) to U.S. dollars (US$) at the average exchange rate of 5.33EGP=US$1.00.

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operators and 25 were partners with the Ministry of Petroleum. Among these companies, seven were local operators [Gharib Oil Services, Glob Oil, Masawa Co., Petzed Investment and Project Management Ltd. Co. (a subsidiary of the National Petroleum Co.), Pico International Petroleum, Tharwa Petroleum Co., and Trident Petroleum Egypt] and one was a local partner company (Sahara Petroleum Services Co. S.A). International companies that were exploring for hydrocarbons in Egypt included Apache Egypt Co. of the United States; BG Egypt, BP Egypt, and Perenco North Sinai Petroleum Co. Ltd. (all of the United Kingdom); Dana Gas P.S.C.G. of the United Arab Emirates, Gaz de France; INA-Naftaplin of Croatia; Lukoil Co. of Russia; RWE-Dea A.G. of Germany, O.M.V. Aktiengesellschaft of Austria; and Shell Egypt N.V. of the Netherlands. The Government continued to play a significant role in the mineral industry and the local market, despite privatization efforts (Ministry of Petroleum and Mineral Resources, 2009).

El Nasr Mining Co., which was a subsidiary of Metallurgical Industries Holding Co., produced several mineral commodities in 2008, including barite, clay, feldspar, gypsum, ilmenite, iron ore (iron oxide), kaolin, magnesite, phosphate rock, quartz, and talc (El Nasr Mining Co., 2009). TAS Flowrance Group was a private company that produced and exported dolomite, feldspar, fluorite, granite, limestone, marble, phosphate rock, quartz, sandstone, silica sand, and talc from its mines at Aswan, El Minya, and the Red Sea coast (TAS Flowrance Group, 2009).

EMRA was in a 50-50 partnership with Centamin Egypt Ltd. of Australia for the development of the Sukari Gold Mine project. EMRA was also a partner with Gippsland Ltd. of Australia to develop the Abu Dabbab's tantalum-tin-feldspar deposit and the Wadi Allaqi's gold-copper-nickel deposit. The cement and steel markets had state-owned and private producers but were dominated by listed private companies. MTI was responsible for issuing licenses to build cement, fertilizer, and steel plants and for regulating the cement and steel markets. In 2008, MTI issued eight permits for new cement plants and two for the expansion of existing plants (Capital Research, 2008, p. 35; Global Investment House, 2008).

Mineral Trade

Egypt's petroleum products exports and imports were valued at $18.0 billion, or 23.9% of Egypt's external trade (the sum of exports and imports), which was valued at $75.5 billion in fiscal year 2008-09. Exports of petroleum and petroleum products in fiscal year 2008-09 were valued at $11.0 billion, or 43.7% of the country's total exports of goods compared with $14.5 billion in fiscal year 2007-08, or 49.3% of the total exports of goods. The value of petroleum products imports was $7.0 billion in fiscal year 2008-09, or 8.8% of total imports compared with $9.6 billion, or 8.5% of total imports, in fiscal year 2007-08. Metal trade was valued at $8.1 billion, or 10.7% of total external trade (Central Bank of Egypt, 2009, p. 70, 78).

The volume of crude oil exports averaged 45,000 barrels per day (bbl/d) in 2008, which was more than the 44,000 bbl/d in 2007 but less than the annual average of 57,200 bbl/d that was achieved between 2004 and 2006. Egypt's natural gas exports had been increasing steadily in the past 5 years; they increased by more than sevenfold in 2005 to 8.0 billion cubic meters from just 1.1 billion cubic meters in 2004, and then more than doubled to 16.9 billion cubic meters in 2006. The volume of natural gas exports decreased to 16.0 billion cubic meters in 2007 but again increased to 16.9 billion cubic meters in 2008 (Organization of Arab Petroleum Exporting Countries, 2009, p. 57, 59).

In fiscal year 2008-09, the value of mineral commodity exports was $2.1 billion and that of mineral commodity imports was $6.0 billion. Mineral trade, which includes exports and imports of minerals and mineral-related products, accounted for 10.7% of the country's total external trade (Central Bank of Egypt, 2009, p. 78).

The Suez Canal, which is the waterway that connects the Mediterranean Sea and the Red Sea, was essential for the Egyptian economy, international trade, and world navigation. It contributed about 2.5% of Egypt's GDP in fiscal year 2008-09, down from 3.2% of the GDP in fiscal year 2007-08. Revenue from the Suez Canal was $4.7 billion in fiscal year 2008-09, which was 7.2% less than the $5.1 billion collected in the previous fiscal year. In April 2008, the Suez Canal Authority (SCA), which was the Government agency responsible for operating and managing the waterway, increased duties on ships passing through the canal by between 5% and 10.5%, depending on the ship category. In October, the SCA slashed its fees for certain classes of ships to prevent further reduction of traffic during the global recession. The SCA was also reviewing its fee structure following the decrease in the numbers of ships that passed the Suez Canal as Chinese exports of coal and iron ore to Europe and the United States plummeted significantly in the fourth quarter of 2008 (Middle East Economic Digest, 2008c, p. 18; Central Bank of Egypt, 2009, p. 70).

Sumed Arab Petroleum Pipeline Co. continued to transport petroleum from the Gulf region to Europe in 2008. Sumed composed two 320-kilometer (km)-long pipelines that were capable of carrying 3.1 million barrels per day of crude oil. Sumed was designed to transfer petroleum products from supertankers (tankers that carry more than 200,000 metric tons), which cannot be accommodated by the Suez Canal. Sumed was established as a joint venture of EGPC, which held 50% interest; Saudi Aramco, 15%; International Petroleum Investment Co. of the United Arab Emirates, 15%; Kuwait Investment Co., Kuwait Metal Pipe Industries Co., Kuwait Real Estate Investment Consortium, 15% combined; and Qatar Petroleum, 5% (U.S. Energy Information Administration, 2008; Sumed Arab Petroleum Pipeline Co., 2009)

Commodity Review

Metals

Aluminum.—Primary aluminum was produced by Aluminium Co. of Egypt [Misr Aluminium Co.] (Egyptalum) at Nag Hammady, which was a majority state-owned company located 100 km north of Luxor. Egyptalum continued working on its capacity expansion project, which aimed to increase production to 320,000 metric tons per year (t/yr) from 230,000 t/yr by yearend 2010. The expansion plan called for

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adding a sixth potline and converting the existing Soderberg cells into anode cells (Aluminium International Today, 2009, p. 20).

Copper.—In October, 2008, El Sewedy Cables Egypt announced that it had delayed the planned copper smelter project at Ain Al Sokhna on the Red Sea coast because of "current market conditions." The project, which was announced in June 2007 as the region's first copper refinery, was a joint venture of El Sewedy Cables and Glencore International AG of Switzerland; the plant was designed to produce 300,000 t/yr of copper cathodes at a cost of $850 million (Middle East Economic Digest, 2008a).

Gippsland completed drilling operations at Abu Swayel, which was a copper-nickel prospect located 160 km southeast of Aswan. The company identified a copper mineralization zone, including chalcopyrite, which varied in thickness from 4 to 18 meters (m) alongside historical sites that were mined by the ancient Egyptians (Gippsland Ltd., 2008, p. 16).

Gold.—Gold production in Egypt, which was stopped in 1958, was expected to be resumed in 2009 after a hiatus of more than 50 years. The Government awarded eight exploration licenses to seven international companies in 2006 and six new licenses in November 2007 to explore for gold in the Eastern Desert as part of its scheme to revive its precious metals industry. The new concessions, which would cover various parts of the country, and those already awarded were expected to increase annual output of gold to 8,000 kilograms (kg), which would be more than the country's total production in the past century (Mining Weekly, 2008).

Centamin moved forward with the construction and development work at the Surkari Gold Project, which started in 2007. The project, which covers 160 square kilometers (km^2), was owned and operated by a 50-50 joint venture of Centamin and EMRA. The work included delivering the Kori Kollo plant from Bolivia (where it was dismantled) to the Sukari Mine site; installing a 28-megawatt (MW) powerplant, which used heavy fuel, at the project site; and finalizing project financing. In 2008, Centamin completed civil works at the plant site, built a seawater pipeline and tailing storage facility, and prestripped the mine. The Sukari Mine, which would be the first up-to-date large-scale operating mine in Egypt, is located in the Eastern Desert 23 km southwest of Ras Alam on the Red Sea. Gold mining was scheduled to begin in the third quarter of 2008 but was delayed to the first quarter of 2009. Gold production was expected in the second quarter of 2009. Based on assay results from 14,352 m of drilling, Centamin upgraded the Sukari open pit mineral reserves estimates to 64 million metric tons (Mt) and 78 Mt of proven and probable reserves from 34.1 Mt and 44.2 Mt, respectively. At the end of 2008, gold resources at the Sukari deposit were about 400,000 kg of inferred, measured, and indicated proven and probable reserves (Centamin Egypt Ltd., 2008, p. 6-10).

Gippsland was awarded exploration rights in nine prospects of 16 km^2 each; eight of these prospects had a history of gold mining activity. The exploration areas were located in the Wadi Allaqi in the Eastern Desert, which is located between Lake Nasser on the west and the Red Sea on the east. In 2008, Gippsland was developing mineral resources in the exploration areas, which were estimated to hold 1.1 Mt of gold at a cutoff grade of 0.7 gram per metric ton (g/t) gold (Gippsland Ltd., 2008, p. 20).

Iron and Steel.—In 2008, there were 20 iron and steel producers in Egypt whose combined capacity was 9.6 Mt of iron and steel products. Hot-rolled bar production accounted for about 73% of total production and hot-rolled sheets was 27% of the steel produced. Al Ezz Steel had 65% and 60% of the bar and sheet markets, respectively. Al Ezz Steel acquired a 53% share in Al Ezz Dkheila Steel Co.-Alexandria and built Al Ezz Flat Steel in the Ain Al-Sokhna Free Zone. Other steel producers included state-owned Egyptian Iron and Steel Co. (Hadisolb) and the privately owned Beshay Steel. Hadisolb was the only steel producer that produced steel using Egyptian iron ore. The country's iron ore reserves were estimated to be 600 Mt, 40% of which were concentrated in the Al-Wahat Al-Bahriya district, which is located 365 km southwest of the city of Giza (Arab Steel, 2009).

In December 2007, the General Authority of Industrial Development of the MTI awarded four local steel companies permits to increase billet and sponge iron production by 8 million metric tons per year (Mt/yr). The companies were Ezz Steel, Egyptian Sponge Iron and Steel Co., Suez Steel Co., and Tiba Iron and Steel Co. (Capital Research, 2008, p. 67, 69; Hasan and others, 2009, p. 34).

In 2008, ArcelorMittal of Luxembourg was awarded a permit to build two steel plants in Egypt—a 1.4-Mt/yr-capacity billet plant and 1.6-Mt/yr-capacity direct-reduced iron plant. The cost of the two plants was expected to be between $800 million and $1 billion (Hasan and others, 2009, p. 35).

Gulf United Steel Holding Co. (Foulath) of Bahrain announced plans to build two new 7-Mt/yr-capacity pellet plants in Egypt; one in Alexandria and one in Suez. The engineering, procurement, and construction contracts for one of the plants would be awarded in 2009; contracts for the second plant would be awarded in 2010. It was believed that the plants would use imported iron ore from Brazil similar to the other two nearly identical plants planned by the same company in Bahrain and Oman (Steel Guru, 2009).

Tantalum and Tin.—In 2008, Gippsland completed its drilling program at the Abu Dabbab project. The company reported an ore reserve upgrade of 107% and an 11% increase in the Abu Dabbab project's tantalum total resources to 44.5 Mt based on a cutoff grade of 100 g/t tantalum pentoxide (Ta_2O_5). The project was expected to become the world's leading tantalum mine and would have more than 20 years of mine life. Tantalum Egypt J.S.C. was a 50-50 joint venture of EMRA and Tantalum International Pty Ltd., which was a wholly owned subsidiary of Gippsland. Tantalum production at the Abu Dabbab deposit was projected to exceed 650,000 t/yr of Ta_2O_5 for 20 years. In December 2008, Gippsland announced its intention to produce SynCon, which is a tantalum concentrate that contains 55% Ta_2O_5. Gippsland signed an offtake agreement with H.C. Starck GmbH of Germany for the supply of 600,000 t/yr of Ta_2O_5 for 10 years from the Abu Dabbab project. In addition to tantalum pentoxide, the Abu Dabbab Mine was expected to produce 1,530 t/yr of tin metal in concentrate, which would be sold on the open market. Commissioning of production at the Abu Dabbab Mine was scheduled for 2010

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but was delayed to 2012 because of difficulties in securing financing, which was offered with an 80-20 debt-to-equity model. The International Finance Corp. held 25 million shares, or 8.16% of the total Gippsland shares in 2006. Gippsland also held mining rights for the tantalum-tin deposit at the Nuweibi site, which is located south of the Abu Dabbab deposit. The Nuweibi site contained 98 Mt of tantalum-tin-feldspar mineral resources, which was double that of the Abu Dabbab deposit, but the metal grade of Ta_2O_5 was 40% lower than that of the Abu Dabbab. Given the size of identified resources of 142.5 Mt from the Abu Dabbab and the Nuweibi deposits, Gippsland expected to become the world's leading producer of tantalum for many years to come (Gippsland Ltd., 2008, p. 5; Mining in Africa, 2009, p. 4).

Industrial Minerals

Cement.—In 2008, MTI, through the Egyptian Competition Authority, investigated anticompetitiveness practices of local cement producers and found the presence of a cartel among cement producers, which broke antimonopolies law and kept portland cement prices at higher levels during 2005 and 2006. Therefore, MTI recommended penalizing cement companies with fines that ranged between 10% and 15% of the companies' profit. In August 2008, an Egyptian court found 20 cement industry executives guilty of violating the Protection and Prohibition of Monopolistic Practices law No. 3 of 2005, charged them with price fixing, and fined them each a $1.87 million penalty (El Madany, 2008).

In 2008, the Government increased natural gas and electricity prices (which make up about 53% of the cement production cost) and added a resource development fee on the price of the clay used as an ingredient in cement production. The Government expected that cement consumption would increase sharply in the next 5 years and lead to an estimated increase in cement production to 50 Mt in 2009 from 40 Mt in 2008. Out of the 13 cement companies that were present in Egypt in 2008, one was state-owned (National Cement Co.), four were private and locally owned, and eight were owned by international companies. The country's cement production capacity was 41.3 Mt in 2007. Cement production capacity was expected to increase to more than 60 Mt/yr by 2012 once the construction of the 10 new greenfield plants, the expansions of 2 existing plants, and the refurbishing of 5 old plants were completed (Global Investment House, 2008).

In June 2008, The Vicat Group announced the commissioning of a new kiln at the Sinai Cement Plant in El-Arish, thus doubling the plant's capacity to 3.5 Mt/yr. Italcimenti Group of Italy was the leading producer of cement in Egypt by holding a 31% share of the market through its subsidiaries, which included ASEC Cement-Helwan, Suez Cement, and Torah Cement. Lafarge S.A. of France became the second ranked cement producer in Egypt, accounting for 21% of the Egyptian cement market after finalizing its takeover of Orascom Construction Industries (OCI) Cement Group in January 2008. Lafarge held 54% equity interest in Egypt Cement Co., which had a capacity of 10 Mt/yr of cement. Lafarge sold its 50% share in Lafarge Titan Cement Co. to Titan Cement Co. of Greece. The new company, which became known as TITAN Cement Egypt, was 100% owned by TITAN, and had two plants—Alexandria Portland Cement Co. near Alexandria and Beni Suef Cement Co. near Cairo. The two plants had a combined capacity of 3.3 Mt/yr of cement. Construction work to add a second production line at the Beni Suef cement plant began in 2008. The new line, which was expected to commence production by yearend 2009, would increase the production capacity of TITAN's two plants in Egypt to 5 Mt/yr (Global Investment House, 2009; Lafarge S.A., 2009, p. 10-13; TITAN Cement Co. S.A, 2009, p. 18).

In 2008, Qena Cement Co., which was a local private sector plant, established a new 1.5-Mt/yr-capacity cement plant at Qena, which is located about 50 km from Luxor. The plant would be completed in 2010, and was expected to export 30% of its production. The owners of the plants were the Holding Company for Chemical Industries, Al Qawmiya Cement, and the Holding Company for Insurance and Arab Contractors Co. (International Cement Review, 2008, p. 16).

Nitrogen.—In August, state-owned Misr Oil Processing Co. S.A. (MOPCO) acquired Egyptian Agrium for Nitrogen Products (EAgrium), including its contractual obligations and rights, from Agrium Inc. of Canada. According to the share swap agreement, Agrium had 26% interest in the new combined company and EAgrium shareholders became MOPCO shareholders. MOPCO completed the construction of a nitrogen fertilizer plant at Rehab Industrial Zone in Damietta; the plant had the capacity to produce 675,000 t/yr of urea. The combined company planned to build two additional urea trains to increase urea production capacity to 2 Mt/yr (Agrium Inc., 2008).

Egypt Basic Industries Corp. (EBIC) completed the construction of a new ammonia plant at Ain Al-Sokhna near the city of Suez. Commissioning of the plant was scheduled for the third quarter of 2009 but it was delayed until January 2010. The plant, which was majority (60%) owned by Orascom, would have the capacity to produce 670,000 to 700,000 t/yr of ammonia for export. The plant received a $229 million long-term guarantee from the Export-Import Bank of the United States (U.S. Trade and Development Agency, 2009, p. 13).

In 2008, Orascom acquired 100% of the Egyptian Fertilizer Co. from the fertilizer operations of Abraaj Capital of the United Arab Emirates for $1.59 billion. Egyptian Fertilizer had a capacity of 792,000 t/yr of ammonia and 1.27 Mt/yr of urea. The plant was located at the Ain Al Sokhna Port in the Gulf of Suez and was undergoing a debottlenecking project, which was expected to increase the production capacity to 1.45 Mt/yr of urea by 2010 (AMEinfo.com, 2008; Orascom Construction Industries, 2009).

Phosphate Rock.—In 2008, Egypt's output of phosphate rock increased by 42% to 5.5 Mt from 3.9 Mt in 2007. The increase in 2008 followed another increase of about 77% in 2007. Phosphate rock was produced mainly by El Nasr Mining Co. at the East Sebaya Mine, the West Sebaya Mine, the Red Sea Mine at El Qusier, and the Abu Tartur Mine. The Abu Tartur Mine is located in the Western Desert about 50 km west of El Kharga, which is the capital of New Valley Governorate. Phosphate rock was transported by railway to Safaga Port on the Red Sea. Following the Government's decision to liberalize the fertilizer industry and to embark on a long-term plan for reforming the

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agriculture sector in 2007, Egyphos was established as a joint venture of Abu Qir Fertilizer and Chemical Industries Co., Helwan Fertilizer Co., El-Nasr Mining, Polyserve for Fertilizers and Chemical Co., and Egyptian Financial and Industrial Co. Egyphos was formed in August 2008 to build a $680 million nitrogen, phosphate, and potassium fertilizer plant at Idfu, which is located in Aswan Governorate. Idfu had also been chosen as the site of a $350 million fertilizer production project that was partially financed by the International Finance Corp. in 2007. The project included establishing a greenfield phosphoric and sulfuric acid plant operated by Indian-Egyptian Fertilizer Co., which was a joint venture of Indian Farmers Fertilizer Cooperative Ltd. (IFFCO) of India (76% interest) and El Nasr Mining (24% interest). The plant was expected to produce more than 500,000 t/yr of phosphoric acid and 1.6 Mt/yr of sulfuric acid. El Nasr Mining agreed to supply about 2 Mt/yr of phosphate rock from the Sebaya Mine, and IFFCO agreed to offtake the entire production. The General Authority for Investment and Free Zones granted the project private free-zone status (International Finance Corp., 2007; Egyptian Financial and Industrial Co., 2009; Middle East Economist Digest, 2009a, p. 18).

Soda Ash.—In 2008, state-owned Chemical Industries Holding Co. sold 80% of its shares in Alexandria Sodium Carbonate Co. to Solvay S.A. of Belgium. Solvay had plans to increase the production capacity to 200,000 t/yr in the first phase and to 500,000 t/yr in the second phase of expansion (Maree, 2008).

Mineral Fuels, Related Materials, and Other Sources of Energy

Coal.—Egypt's coal reserves were estimated to be about 50 Mt. Coal was produced by state-owned Sinai Mining Co. from the Al Maghara underground mine in the northern part of Sinai at an average rate of 360,000 t/yr. In 2008, the Government was planning to invite international investors to develop the mine to export a fraction of its coal production as the local demand for coal was decreasing owing to the increasing use of natural gas by the steel industry in Helwan, which was the main user of coal. The Government was studying a proposal by the Arab Investment and Development Co. to build a 5,000-MW coal-fired powerplant at Safaga, which is located on the Red Sea coast (Ridely-Wordrich, 2008; Middle East Economic Digest, 2009b, p. 14).

Natural Gas.—Seventy-eight percent of Egypt's gas reserves lies under the Mediterranean Sea, 10% occurs in the Western Desert, 8% in the Gulf of Suez, and 4% in the Nile Delta. The Government policy of intensifying gas and oil exploration activity during the past 3 years paid off through a 5.1% increase in gas reserves, or an increase of 2,128 billion cubic meters in 2008 compared with reserves in 2007 and an 11.4% increase compared with reserves in 2006. The increase in natural gas production averaged 8.5% annually in the past decade. Discoveries of natural gas continued at greater frequency in 2008, totaling 24 discoveries compared with 7 discoveries in 2007 and 22 discoveries in 2006. In 2008, about 48.3 billion cubic meters of dry natural gas was produced in Egypt, which was about 4% more than in 2007. Most of Egypt's offshore discoveries had been natural gas discoveries, which made natural gas the fastest-growing mineral fuel sector in the country in 2008. The Government was getting ready to put seven offshore oil and gas exploration areas up for bid in the Mediterranean Sea, which the Egyptian Natural Gas Holding Co. believed holds 81% of Egypt's confirmed gas reserves (Alexander's Gas & Oil Connections, 2008c; Middle East Economic Digest, 2008b, p. 50; Organization of Arab Petroleum Exporting Countries, 2009, p. 12, 13).

In 2008, Dana Gas pursued a drilling program that focused on Egypt's Nile Delta concessions. The company announced three new gas and condensate discoveries from the El Basnat-1 (originally called Al Tawil-1) and the El Basnat-2 exploration wells of the West Manzala concession and from the Salma-1 exploration well at the West Qantara concession (Dana Gas P.J.S.C., 2008).

In 2008, Eni S.p.A. of Italy moved forward with its gas exploration activity and reported one gas discovery at the Satis-1 gasfield, which is located offshore across the Nile Delta. Eni started production at the Denise gasfield in the El Temsah concession, the Taurt gasfield in the Ras El Bart concession, and the West Ashrafi gasfield. Eni was working to supply natural gas to the first and second trains of the Damietta liquefied nitrogen gas (LNG) plant (Eni S.p.A., 2009, p. 22).

The Arab Gas Pipeline (AGP) and the Arish-Ashkelon Pipeline were Egypt's two major pipelines for exporting gas to neighboring countries. AGP was designed to transport natural gas to Jordan, Lebanon, and Syria. The Governments of Egypt, Jordan, Lebanon, and Syria planned to expand the AGP through Syria to Turkey to be connected with the Nabacco Pipeline, which carried gas to several European countries. The Arish-Ashkelon pipeline was a 100-km-long natural gas pipeline that extended from the Egyptian coastal town of Al-Arish to the Israeli city of Ashkelon. In February 2008, Egypt began supplying Israel with about 60 million cubic meters of natural gas per year. The pipeline was established and operated by East Mediterranean Gas Co. (a partnership of EGPC, which had 68.4% ownership equity); Ampal American-Israel Corp. of Israel (6.6%); and Merhav Group of Israel (25%) (Alexander's Gas & Oil Connections, 2008b, d; Shirkhani, 2008).

Nuclear Energy.—In December 2008, Bechtel Group Inc. of the United States was awarded a 10-year, $180 million contract to consult on and help design Egypt's first nuclear powerplant. Bechtel was expected to evaluate and choose the best nuclear energy technology available on the international market and to select a site for the reactor using international safety standards (Nuclear Power Daily, 2008).

Petroleum.—Thirty-seven crude oil discoveries were made in Egypt in 2008 compared with nine discoveries in 2007. In 2008, EGPC announced a 14-year record level of crude oil production in Egypt of 700,000 bbl/d. Egypt's crude oil production came from the Eastern Desert, the Gulf of Suez, the Nile Delta, the Sinai Peninsula, and the Western Desert. The increase in production (55,000 bbl/d) was attributable to the startup of production at new oilfields in the Gulf of Suez, the Nile Delta, and the Western Desert (Alexander's Gas & Oil Connections, 2008a).

Renewable Energy.—The Government expected the demand for energy to increase by between 6% and 7% in the next 10 years, which was about the same increase as in the previous decade. Thus, the Government had a goal to meet 80% of the

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country's future energy demand from conventional energy sources and 20% from renewable energy sources by the year 2020.

In December 2007, the World Bank approved a financial package for the first solar thermal hybrid project in Egypt—the Kureimat Integrated Solar Combined Cycle Power Project—at a cost of about $328 million. The project received a loan of $151 million from Japan Bank for International Cooperation, a loan of $126 million from the National Renewable Energy Authority (NERA), and grants of $50 million from the Global Environment Facility. The 150-MW powerplant was being built by OCI at Kureimat, which is located 95 km south of Cairo. The project was expected to commence production in 2011. It would use both natural gas and solar energy to generate electricity (World Bank, The, 2007).

The Zafarana Windfarm was Egypt's the first wind-energy facility; it was established in 2001 and became operational in 2004. The farm was built by Gamesa Corporación Tecnológica S.A. of Spain, Nordex A.G. of Germany, and Vestas Wind Systems A/S of Denmark. The current (2008) capacity of the farm was 360 MW (Renewable Energy Development, 2008).

Outlook

The Egyptian mineral industry is expected to continue to grow extensively during the next 5 years owing to the country's abundant mineral resources, including, gold, natural gas, crude oil, and tantalum, and because of the Government's recent restructuring of the mining sector. The Government plans to develop the mineral resources of the Sinai Peninsula and the South Valley region of the country. Egypt is working on diversifying its energy production capabilities, including developing renewable energies, which are targeted to account for 20% of the country's total energy portfolio by the year 2020. Egypt is on track to becoming a major exporter of gold, natural gas, nitrogen and phosphate fertilizers, phosphate rock, and tantalum.

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TABLE 1
EGYPT: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Aluminum metal		215	244	252	258	260
Copper, refined, secondary		14	14	14	12	12
Iron and steel:						
Iron ore and concentrate, gross weight		2,287	1,599	1,600 e	2,185 r	1,811
Metal:						
Pig iron e		1,000	1,100	1,100	1,000	1,000
Direct-reduced iron		3,000 r	2,900 r	3,100 r	2,800 r	2,600
Steel, crude		4,777	5,565	6,004	6,224	6,198
Ferroalloys:						
Ferromanganese e		30	30	30	30	30
Ferrosilicon e		55	55	50	50	50
Manganese ore, gross weight		46	17	17	13 r	7
Titanium, ilmenite		120	120	120	108 r	88
INDUSTRIAL MINERALS						
Barite	metric tons	500 e	500 e	500 e	50 r	1,080
Cement, hydraulic, all types		28,763	29,000 e	36,100 r	38,469 r	40,144
Clays:						
Bentonite e		30	30	30	30	32
Fire clay e		300	300	300	300	300
Kaolin		295	415	416	332 r	523
Feldspar, crude		178	357	360	135 r	169
Fluorspar	metric tons	891	549	550	1,080 r	470
Gypsum and anhydrite, crude		7,634	3,290	3,300 e	3,007 r	2,381
Iron oxide pigments		NA	NA	NA	39	26
Lime e		800	800	800	1,000 r	1,000
Mica	cubic meters	NA	NA	NA	395	100
Nitrogen:						
Ammonia, N content		1,790 r	1,750 r	1,957 r	2,000 e	2,500 e
Urea, N content		1,120 r	1,110 r	1,300 r	1,500 e	2,000 e
Phosphate:						
Phosphate rock		2,223 r	3,371 r	2,177 r	3,890 r	5,523
P_2O_5 content		667 r	1,011 r	653 r	1,167 r	1,657
Sodium compounds:						
Salt		1,010	1,200 e	1,200 e	227 r	271
Soda ash e		50	50	50	50	50
Sodium sulfate e	metric tons	2,500	2,500	2,500	2,500	2,500

See footnotes at end of table

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TABLE 1—Continued
EGYPT: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Stone, sand and gravel:						
Basalt	thousand cubic meters	243	249	250 e	150 r	235
Dolomite	do.	949	1,371	1,400 e	4,000 r	37,505
Granite, dimension stone	do.	22,155	15,083	15,000 e	8,651 r	19,461
Limestone and similar	do.	25,000 e	25,000 e	25,000 e	28,103 r	35,569
Marble (includes alabaster) blocks		401	401	400	427 r	420
Quartz		NA	NA	NA	169	235
Sand:e						
Industrial sand (glass sand)	thousand cubic meters	650	650	650	690 r, 3	645 3
Sand and gravel	do.	21	21	21	76 r, 3	630 3
Sandstone	do.	60	1,125	1,100 e	174 r	162
Sulfur:						
Elemental, byproduct		20 r	20 r	20 r	20 r	20
Sulfuric acid, S content e		220	220	200	200	200
Talc, soapstone, pyrophyllite		54	39	40 e	41 r	44
Vermiculite		12 e	12 e	12 e	6 r	8
MINERAL FUELS AND RELATED MATERIALS						
Coal e		300 r	300 r	300 r	360 r	360
Coke		1,400 e	1,400 e	1,400 e	574 r	626
Gas, natural:						
Gross production	million cubic meters	33,000 r	42,500 r	54,700 r	55,700 r	58,900
Dry e	do.	18,000	23,000	23,700	37,000	40,000
Petroleum:						
Crude, including condensate	thousand 42-gallon barrels	245,645	240,170	233,235	228,610 r	240,990
Refinery products:						
Liquefied petroleum gas	do.	5,256 r	5,220 r	5,037 r	6,345 r	7,053
Gasoline and naphtha	do.	58,772	60,417	60,000 e	55,912 r	58,428
Kerosene and jet fuel	do.	12,884 r	13,724 r	11,461 r	19,024 r	20,223
Distillate fuel oil	do.	45,260 r	43,982 r	45,808 r	63,723 r	67,125
Residual fuel oil	do.	69,642 r	77,782 r	70,774 r	68,255 r	69,935
Lubricants	do.	2,590	2,576 r	2,600 e	1,792 r	1,862
Asphalt e	do.	5,800	5,800	5,800	5,563 r, 3	5,266 3
Other e	do.	2,200	2,200	2,200	2,066 r, 3	1,970 3
Total	do.	202,404 r	211,701 r	204,000 r, e	222,680 r	231,862

eEstimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised. do. Ditto. NA Not available.

[1]Table includes data available through March 31, 2010.

[2]In addition to those listed, Egypt produced a number of commodities for which data were unavailable, including gemstones; a number of metals, such as gold, lead (which was produced from recycled material), and zinc; and manufactured mineral commodities, such as carbon black and glass.

[3]Reported figure.

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TABLE 2
EGYPT: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	Aluminium Co. of Egypt (Egyptalum) (Government, 80%, and private interests, 20%)	Nag Hammadi	230.
Aluminum, secondary	The Egyptian Copper Co.	Alexandria	50.
Carbon black	Alexandria Carbon Black Co. (Egyptian Holding Co. for the Chemical Industry, 49%; Inco-Bharat, 36%; Grasim Industries 15%)	do.	20.
Cement	Egyptian Cement Co. (Lafarge S.A., 54%; private interests, 26%; Holcim Ltd., 20%)	70 kilometers east of Cairo	10,000.
Do.	Amirya Cement Co.	do.	4,450.
Do.	Assuit Cement Co. (Cemex Egypt)	Assiut	4,752.
Do.	Arab Swiss Engineering Co. (ASEC) (Suez Cement Co., 68.7%)	Helwan	3,615.
Do.	TITAN Cement Egypt (TITAN Cement Co., 100%)	Alexanderia and Beni Suef	3,300.
Do.	Suez Cement Co. (Cements Français S.A., 54.2%)	Suez	4,200.
Do.	Helwan Cement Co. (Suez Cement Co., 98.69%)	Helwan	4,500.
Do.	Torah Portland Cement Co. (Suez Cement Co., 66.12%)	Torah	4,625.
Do.	Alexandria Portland Cement Co. (Government, 77%, and private interests, 23%)	El Mex	800.
Do.	National Cement Co. (Government, 77%, and private interests, 23%)	El Tabbin	3,100.
Do.	Misr Beni Suef Cement Co.	Beni Suef	2,800.
Do.	Misr Cement Co. (Qena)	Qena	1,400.
Do.	Sinai Cement Co.	Sinai	1,500.
Do.	South Valley Cement Co.	do.	1,400.
Do.	Sinai White Cement Co.	do.	410.
Do.	Arabian Cement Co.	El Ain El Sokhna	1,778 clinker.
Coke	El Nasr Coke and Chemical Co. (Government, 100%)	Helwan	1,400.
Fertilizers, nitrogenous	Abu Qir Fertilizer & Chemical Industries Co. [Private and public interests, 80.9%, and Egyptian General Petroleum Corp. (EGPC), 19.1%]	Abu Qir A	660 (ammonia); 760 (ammonia nitrate).
Do.	do.	Abu Qir B	300 (ammonia); 500 (urea).
Do.	do.	Abu Qir C	330 (ammonia); 600 (urea).
Do.	Alexanderia Fertilizer Co. (Alexfert) (private, 80%, and Abu Qir Fertilizer & Chemical Industries Co., 20%)	Alexanderia	440 (ammonia; 720 (urea).
Do.	El Nasr Fertilizers and Chemicals Co. (SEMADCO) (Government, 100%)	Suez	146 (ammonia); 450 (nitric acid); 365 (ammonia nitrate).
Do.	Egyptian Chemical Industries (Government, 100%)	Kima	330 (ammonia); 600 (nitric acid); 800 (ammonium nitrate).
Do.	Egyptian Fertilizers Co. (Orascom Construction Industries, 100%)	Ain Al Sokhna, Suez	1,300 (urea).
Do.	EL Delta Company for Fertilizers and Chemical Industries (ASMEDA) (Government, 100%)	Talkha, Mansoura	130 (ammonia); 330 (nitric acid); 182 (urea).
Do.	Helwan Fertilizer Co. (private, 100%)	Helwan	440 (ammonia); 700 (urea).
Fertilizers, phosphatic	Abu Zaabal Fertilizers and Chemicals (private, 100%)	Qalyubiyah	730 (superphosphate); 60 (phosphoric acid).
Do.	Egyptian Financial and Industrial Co. (private, 100%)	Kafr El Zayat	750 (superphosphate);
Do.	do.	Assuit	750 (superphosphate).
Do.	Polyserve for Fertilizers and Chemicals (private, 100%)	Cairo	320 (superphosphate).
Do.	Suez Company for Fertilizers Production (Egyptian Financial and Industrial Co., 99.8%)	Ain Al-Sokhna	450 (superphosphate).
Ilmenite	El Nasr Mining Co.	NA	120.

See footnotes at end of table

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TABLE 2—Continued
EGYPT: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron:				
Ore		Egyptian Iron and Steel Co. (Government, 100%)	El-Gedida Mine, El Bahariya	3,000.
Oxide		El-Nasr Mining Co. (Holding Company for Metallurgical Companies, 100%)	Mines near Sinai and Aswan	150.
Natural gas	million cubic meters	Egyptian General Petroleum Corp. (EGPC) (Government, 100%)	Abu Madi	3,800.
Do.	do.	do.	Badreddin-3	3,000.
Do.	do.	do.	Abu Qir/Naf	1,900.
Do.	do.	Egyptian General Petroleum Corp. (EGPC) (Government, 100%)	Ras Shukheir	1,600.
Do.	do.	Grupo Khalda (Repsol YPF S.A., 50%; Apache Oil Co., 40%; Samsung Corp., 10%)	Khalda	24.
Petroleum:				
Crude	million 42-gallon barrels	Gulf of Suez Oil Co. [Egyptian General Petroleum Corp. (EGPC), 50%, and BP Amoco, 50%]	October, Suez Gulf	45.
Do.	do.	do.	El Morgan, Suez Gulf	27.
Do.	do.	Belayim Petroleum Co. [Egyptian General Petroleum Corp. (EGPC), 50%, and International Egyptian Oil Co., 50%]	Belayim, Suez Gulf	65.
Do.	do.	Suez Oil Co. [Egyptian General Petroleum Corp. (EGPC), 50%; Deminex SA, 25%; Repsol YPF S.A., 25%]	Ras Budran, Suez Gulf	15.
Pipeline	do.	Arab Petroleum Pipeline Co. (Governments of Egypt, 50%; Saudi Arabia, 15%; Kuwait, 15%; United Arab Emirates, 15%; Qatar, 5%)	Ain al-Sokhna to Sidi Kir	875.
Refined	do.	Cairo Petroleum Refining Co. (Government, 100%)	Mostorod	42.
Do.	do.	do.	Tanta	15.
Do.	do.	Alexandria Petroleum Co. (Government, 100%)	Alexandria	42.
Do.	do.	El-Nasr Petroleum Refining Co. (Government, 100%)	Suez	36.
Do.	do.	Ameriya Petroleum Refining Co. (Government, 100%)	Ameriya	27.
Do.	do.	Suez Petroleum Processing Co. (Government, 100%)	Suez	21.
Do.	do.	Asyut Petroleum Refining Co. (Government, 100%)	Asyut	18.
Phosphate rock		El-Nasr Mining Co. (Holding Company for Metallurgical Companies, 100%)	Mines at East Sabaiya, West Sabaiya, and El Qusier	2,250.
Do.		National Company for Mining and Quarries (Elwataneya)	NA	400.
Quartz		El-Nasr Mining Co.	NA	235.
Steel		Ezz El-Dekheila Steel Co. (EZDK) (Al Ezz Steel Rebars S.A., 53.2%)	Alexandria	2,700.
Do.		Egyptian Sponge Iron and Steel Co. (ESISCO) (Beshay Steel Group)	Sadat City	1,760.
Do.		Al Ezz Flat Steel Co.	Suez	1,200.
Do.		Egyptian American Steel Rolling Co. (Beshay Steel Group)	Sadat City	1,200.
Do.		Egyptian Iron and Steel Co., Hadisolb (Government, 100%)	Helwan steel plant	1,000.
Do.		Al Ezz Steel Rebars S.A.	Sadat City	1,000.
Do.		Kandil Steel	Tenth of Ramadan City	1,000.
Do.		Al Ezz Rolling Mills	do.	400.
Do.		International Steel Rolling Mills (Beshay Steel Group)	Sadat City	800.
Do.		Suez Steel Co.	Suez	500.
Do.		National Port Said Steel	Port Said	400.
Do.		Misr National Steel Co.	Heliopolis	360.
Do.		Kouta Steel Group	Port Said	360.
Sulfuric acid		Abu Zaabal Fertilizers and Chemicals (private, 100%)	Qalyubiyah	350.
Do.		Egyptian Financial and Industrial Co. (private, 100%)	Kafr El Zayat	175.
Do.		do.	Assuit	210.
Do.		Suez Company for Fertilizers Production (Egyptian Financial and Industrial Co., 99.8%)	Ain Al-Sokhna	425.
Talc		El Nasr Mining Co.	NA	50.

Do., do. Ditto. NA Not available.

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The Mineral Industry of Equatorial Guinea

By Philip M. Mobbs

Offshore oil and natural gas production dominated Equatorial Guinea's mineral industry. In 2007, which was the latest year for which data were available, hydrocarbons [crude oil and derivatives, such as liquefied petroleum gas (LPG)] accounted for about 85% of the country's nominal gross domestic product. In 2008, Equatorial Guinea ranked seventh (based on production volume) of all African crude oil producers (BP p.l.c., 2009, p. 8; Stotsky and others, 2009, p. 2).

Mineral resources are the property of the Government. Mineral exploration and production activity are governed by law No. 9/2006, which is the Mining Law, and law No. 8/2006, which is the Hydrocarbon Law. Contracts for hydrocarbon exploration and production are administered by the Ministerio de Minas, Industria y Energia. Law No. 7/2003 and amendments form the Environmental Law.

Most of Equatorial Guinea's mineral-related production, which included crude oil, liquefied natural gas (LNG), methanol, and natural gas condensate, was exported. Clay, gravel, sand, and volcanic rock output was used by the domestic construction sector, and some of the LPG output was consumed locally.

Production

The country's mineral sector was based on the production of mineral fuels, such as condensate, crude oil, and natural gas that were produced from offshore fields. Natural gas production from the Alba field was processed at the Alba plant (which was a facility located at Punta Europa on Bioko Island) where the condensate and LPG were stripped from the wet gas stream; the remaining dry gas was piped to the adjacent methanol and LNG facilities. Natural gas compressed to liquefied natural gas, processed to produce methanol, or used as a rig or plant fuel increased by 23% in 2008 compared with that of 2007, whereas methanol production was estimated to have dropped by about 29% (table 1).

Marketed natural gas production continued to increase in 2008 as the LNG plant completed a full year of operations. Prior to the commissioning of the LNG Train 1 in 2007, excess natural gas from the Alba field was reinjected into the gasfield and natural gas from the oilfields was flared or reinjected for oilfield reservoir pressure maintenance.

Crude oil production from the Zafiro field on Block B, which was the country's major oilfield and was operated by Mobil Equatorial Guinea Inc., declined by about 12% in 2008. Production from the Ceiba field and the Okume Complex on Block G, which were operated by Hess Equatorial Guinea Inc., increased by about 29% in 2008 and exceeded the oilfields' combined nominal design capacity, although production was expected to decline by about 12% in 2009 (table 2; Tullow Oil plc, 2009, p. 6).

Structure of the Mineral Industry

Hydrocarbon exploration and production activity was governed by production-sharing contracts held by joint ventures of international oil companies and the Government. Guinea Ecuatorial de Petróleos (GEPetrol), which was the national oil company, operated some exploration-stage production-sharing contracts and managed the state's interest in other crude oil exploration and production contracts. Sociedad Nacional de Gas de Guinea Ecuatorial (Sonagas), which was the Government's natural gas company, managed the Government's interest in products derived from natural gas output, such as LNG, LPG, and methanol. The Hydrocarbon Law allowed both GEPetrol and Sonagas to increase their carried interest in petroleum exploration and development projects to no less than 20%. Under the law, expenditures associated with hydrocarbon exploration or production would be funded by the other joint-venture partners until the Government converted its carried interest in a contract area to a participating interest.

In 2008, GEPetrol acquired a 23.75% participating interest in the Zafiro oilfield from Devon Energy Corp. of the United States, which had acquired the interest in the Zafiro operations in 2003 when it merged with Ocean Energy Inc. GEPetrol also acquired Devon's interest in the contracts for Blocks C and P, which were at the exploration stage.

Commodity Review

Mineral Fuels

Natural Gas.—Development of a 4.4-million-metric-ton-per-year (Mt/yr)-capacity LNG plant at Punta Europa remained under evaluation by partners Marathon Equatorial Guinea Production Ltd. of the Cayman Islands (35%), Sonagas (30%), Mitsui & Co. Ltd. of Japan (8.5%), Marubeni Corp. of Japan (6.5%), E.On Ruhrgas of Germany (5%), and Union Fenosa S.A. of Spain (5%). The new LNG train would be adjacent to the 3.7-Mt/yr-capacity LNG plant that was completed in 2007 by Equatorial Guinea LNG Holdings Ltd., which was a joint venture led by Marathon (Quinlan, 2008).

A group composed of African Gas Development Corp. of South Africa, Gasol plc of the United Kingdom, and Sonagas sought to obtain the rights to gather and sell natural gas that was being flared from the Zafiro field. Gasol had proposed to gather and liquefy natural gas from fields in several countries across the Gulf of Guinea. Initial LNG production was planned to begin in 2014 (Gasol plc, 2009, p. 24).

Petroleum.—In December, a subsidiary of Noble Energy Inc. of the United States submitted a development plan for the Benita prospect on Block I. If the Government were to approve the plan in 2009, initial production from the proposed Benita oilfield could begin as early as 2012 (Noble Energy Inc., 2009, p. 11).

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In 2007, Pioneer Natural Resources Equatorial Guinea Ltd. of the Cayman Islands entered into arbitration proceedings with joint-venture partners Atlas Petroleum International Ltd. of Nigeria, Roc Oil (Equatorial Guinea) Co. (which was a subsidiary of Roc Oil Company Ltd. of Australia), and Osborn Resources Ltd. (which was a subsidiary of PA Resources AB of Sweden) concerning their obligations regarding a proposed second exploration well on Block H. In 2008, Pioneer's 50% interest in the exploration joint venture was distributed to the other partners (PA Resources AB, 2008).

Outlook

In the past two decades, improved deepwater production technology, increased petroleum exploration, and the international demand for crude oil and natural gas have transformed the area around Equatorial Guinea into a notable hydrocarbon region. The existing and proposed LNG plants and the production and export of commodities associated with natural gas, such as LPG and methanol, have provided the impetus for the development of the infrastructure necessary to capture natural gas, although the local market for the gas is very limited.

Despite the decline in international oil prices in late 2008, several exploration wells were scheduled to be drilled. In 2009 and 2010, new exploration wells are expected to be drilled on Blocks B, H, O, R, and S. Crude oil production from Equatorial Guinea is expected to continue to decrease in the short term, but hydrocarbon discoveries on Blocks B, I, O, and P have the potential to offset the decline partially by 2013.

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TABLE 1
EQUATORIAL GUINEA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand 42-gallon barrels unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Gold	kilograms	150	200	200	200	200
Liquefied petroleum gas		875	3,035 [4]	7,562 [4]	8,022 [4]	8,000
Methanol	metric tons	913,000	1,110,000	752,000	1,098,000 [4]	775,000
Natural gas						
Gross	million cubic meters	1,390	2,300	2,000	2,300	2,500
Net[5]	do.	473 [4]	678 [4]	438 [4]	1,369 [4]	1,685 [4]
Petroleum, crude and condensate		128,000	131,000	125,000	127,000	120,000

do. Ditto.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through October 28, 2009.

[3]In addition to the commodities listed, Equatorial Guinea presumably produced a variety of crude construction materials (clay, gravel, and sand), but available information is inadequate to make reliable estimates of output.

[4]Reported figure.

[5]Includes natural gas that was compressed to liquefied natural gas, used to produce methanol by Atlantic Methanol Production Company L.L.C., or used as rig or processing plant fuel.

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TABLE 2
EQUATORIAL GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(42-gallon barrels unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Artisanal placer operations	Aconibe, Coro, and Mongomo	500
Liquefied natural gas	metric tons	Equatorial Guinea LNG Holdings Ltd. [Marathon Equatorial Guinea Production Ltd., 60%; Sociedad Nacional de Gas de Guinea Ecuatorial (Sonagas), 25%; Mitsui & Co. Ltd., 8.5%; Marubeni Corp., 6.5%]	Punta Europa	3,700,000
Liquefied petroleum gas		Alba Plant LLC [Marathon Oil Co., 52%; Noble Energy Equatorial Guinea Ltd., 28%; Sociedad Nacional de Gas de Guinea Ecuatorial (Sonagas), 20%]	do.	6,000,000
Methanol	metric tons	Atlantic Methanol Production Co. L.L.C. [Marathon Equatorial Guinea Methanol Ltd., 45%; Samedan Methanol, 45%; Sociedad Nacional de Gas de Guinea Ecuatorial (Sonagas), 10%]	do.	1,100,000
Natural gas	million cubic meters	Joint venture of Marathon Oil Co., 63%; Samedan of North Africa Inc., 34%; Guinea Ecuatorial de Petróleos (GEPetrol), 3%	Alba field, Alba Block	2,300
Petroleum:				
Condensate		do.	do.	16,800,000
Crude		Joint venture of Mobil Equatorial Guinea Inc., 71.25%, and Guinea Ecuatorial de Petróleos (GEPetrol), 28.75%	Zafiro field, Block B	102,000,000
Do.		Joint venture of Hess Equatorial Guinea, Inc., 80.75%; Energy Africa Equatorial Guinea Ltd., 14.25%; Guinea Ecuatorial de Petróleos (GEPetrol), 5%	Ceiba field, Block G	12,500,000
Do.		do.	Okume Complex (includes the Ebano, the Elon, the Okume, and the Oveng reservoirs), Block G	12,000,000

Do., do. Ditto.

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The Mineral Industry of Eritrea

By Harold R. Newman

The East African country of Eritrea has occurrences of mineral resources, such as copper, lead, and zinc deposits in the Asmara region; gold deposits in the Precambrian terrains west of Asmara; and iron ore deposits east and south of Asmara. More-detailed research had not been carried out to identify the amount, quality, and type of mineral resources in Eritrea; based on exploration carried out so far, however, results appeared to indicate that a mining industry could possibly be developed.

Several mining companies were involved in mineral exploration in 2008. Major exploration target areas were Adinfas, Embaderho, Ketina, and Mdrizien in the Maekel Region; Bisha in the Gash Barka Region; Dbarwa in the Southern Region; and Kerkebet, Melhoy, Melobso, Wegrait, and Zara in the Ansseba Region. Notable exploration successes include several high-grade volcanic massive sulfide (VMS) discoveries that have been made in the past 6 years, The Southern and Northern Red Sea regions were being explored as major sources of raw materials for the cement industry (People's Front for Democracy and Justice, 2008).

Minerals in the National Economy

All mineral resources in Eritrea are the property of the state and licenses are required for the exploration and development of these resources. Contributions by mining and quarrying to the gross domestic product were not significant. The Government indicated that mining could help contribute to the economic development of Eritrea. Six exploration companies conducted exploration activities in different parts of the country in 2008; they were Beijing Donia Resources Co. Ltd. and Eritrea China Mining Corp. of China; Nevsun Resources Ltd. and Sanu Resources Ltd. of Canada; and Sub Sahara Resources NL of Australia. The legal framework governing the conduct of all mining and related operations is embodied in a mining code that comprises Minerals Proclamation No. 68/1995, Mining Income Tax Proclamation No. 69/1995, and Regulations on Mining Operations Legal Notice No. 19/1995, all of which were promulgated in March 1995. The Government has a right to a 10% free stake in mining ventures and the right to purchase an additional 30% share at the market price. The Government continued to show strong support for the redevelopment of mining as an important sector of the national economy and indicated that it was relying on mining operations for gold and other minerals to help solve the country's economic problems (Ministry of Energy and Mines, 2008).

Production

Eritrea produced a variety of minerals and mineral products, including basalt, cement, common clay, coral, granite, gravel, gypsum, kaolin, lime, limestone, marble, pumice, quartz, salt, sand, and silica sand (table 1). Small amounts of gold were produced in western Eritrea by artisanal miners. The country had deposits of asbestos, barite, copper, feldspar, iron ore, lead, magnesium, nickel, potash, silver, talc, and zinc that were not exploited in 2008. Gypsum and salt were the only mineral commodities exported in 2008. Refined petroleum products were imported to meet domestic needs.

Structure of the Mineral Industry

Table 2 is a list of the major mineral industry facilities and their capacities.

Commodity Review

Metals

Gold.—Eritrea's gold mineralization was typically hosted in quartz veins and stock works in shear zones associated with felsic volcanic rocks and dioritic intrusions, and in various schists. Gold also occurs within exhalative VMS deposits and in the weathered and supergene zones overlying them. These deposits occur in the highlands near the capital of Asmara and include the Emba Derho prospect, which was owned by Sunridge Gold. Another VMS area is located in the lowlands and includes the Bisha and the Harena projects of Nevsun Resources, and the Hambok project of Sanu Resources (Ministry of Energy and Mines, 2008).

Nevsun Resources's Bisha project is configured in three distinct layered zones: (1) a 35-meter (m)-thick surface oxide zone that contains gold and silver; (2) an underlying 30-m-thick copper-enriched supergene zone; and (3) a primary sulfide zone that underlies the copper-enriched supergene zone and contains both copper and zinc. Construction was initiated in 2008 and included plant site earthwork and expanded camp facilities, and procurement commitments; preparation for project financing was continuing. Commissioning was expected in 2010 (MBendi Information Services (Pty) Ltd., 2008a).

The Zara joint-venture project of Sub Sahara Resources (69%) and Dragon Mining Ltd. (20%) is located at Zara in the northern highlands of Eritrea on the Zara River. The project consisted of four contiguous licenses totaling 196 square kilometers (km^2); the licenses were located about 160 kilometers (km) northwest of Asmara and encompassed several areas of artisanal gold workings. The project was managed by Sub Sahara Resources, which upgraded the estimated resource in 2008 to 5.1 million metric tons (Mt) grading 6.3 grams per metric ton (g/t) gold at a cutoff of 1.5 g/t. The Government was entitled to a 10% free carried interest on the project and up to a 5% royalty on mined precious metals (Dragon Mining Ltd., 2008).

Sunridge Gold reported the gold assay results from 13 diamond drill holes at its Emba Derho VMS deposit. The gold cap extends from the surface to a vertical depth of about 35 m and overlies the copper-gold-zinc deposit. The purpose of the drill program was to expand, further define, and upgrade the surface gold zone from

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inferred to indicated category for inclusion in future resource estimates. The surface gold oxide cap drill highlights were as follows: ED-217-D (13.5 m grading 4.6 g/t gold), ED-220-D (31.5 m grading 1.7 g/t gold), HD-223-D (6 m grading 4.5 g/t gold), and ED-223-D (22 m grading 2.5 g/t gold). An updated resource for the main Emba Derho deposit was scheduled for completion by yearend 2008. The deposit contained an estimated 333,000 metric tons (t) (reported as 735 million pounds) of copper and 770 t (reported as 1.7 billion pounds) of zinc (Mbendi Information Services (Pty) Ltd., 2008b).

Mineral Fuels

Petroleum.—The Government signed two agreements with Defba Oil Share Co. for petroleum exploration and development. Defba Oil Share would undertake exploration activities in two blocks of the Eritrean northern territorial waters in the Red Sea. Defba Oil Share was established through a partnership of the Government and Energy Alliance Co. W.L.L. (Offshore Oil and Gas News, 2008).

Outlook

Eritrea's mineral industry is small but could experience substantial growth in the near future because of the development of metal deposits. Demand for construction materials could increase if Bisha and other metal deposits are developed. Other mineral resources include reserves of barite, feldspar, gypsum, kaolin, marble, and rock salt. If mining develops, Eritrea's proximity to Europe and the Middle East would be favorable for the export of its minerals to these markets.

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TABLE 1
ERITREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2, 3]		2004	2005	2006	2007	2008[e]
Basalt		323,499	119,617	211,053	45,335	50,000
Cement[e]		45,000	45,000	45,000	45,000	45,000
Clays:						
Common		184,250	169,876	29,000	3,700	4,000
Kaolin		46	471	129	183	200
Coral		95,131	91,348	59,900	67,332	65,000
Gold	kilograms	33	25	46	87	50
Granite		192,803	350,280	144,775	21,394	25,000
Gravel		187,070	242,977	187,826	79,913	80,000
Gypsum		715	1,142	634	874	800
Laterite		316	144	NA	NA	NA
Lime		2,915	22,423	164,227	165,000 [e]	165,000
Limestone[e, 4]		2,900	2,900	3,000	3,000	3,000
Marble:						
Block	square meters	780,733	36,046	1,860,146	31,010	32,000
Chip		3,101	972	4,058	NA	NA
Pumice		439	23	1,072	55	60
Quartz		4,496	103	83	90	100
Salt		3,075	6,300	9,737	7,448	7,500
Sand	thousand metric tons	2,100	2,100	2,100	2,309	2,200
Silica sand[e]		32	NA	1,025	NA	NA

[e]Estimated; estimated data are rounded to no more than three significant digits. NA not available.
[1]Table includes data available through June 30, 2009.
[2]Values converted from cubic meters to metric tons. Specific gravity, in grams per cubic meter—basalt, 2.8; clay, common, 1.09; clay, kaolin, 1.03; gypsum, 1.60; laterite, 2.55; lime, 1.54; marble chips, 2.56; pumice, 0.64; quartz, 1.55; salt, 1.44; sand, 2.08; and silica sand, 1.44.
[3]In addition to the commodities listed, feldspar and talc reportedly were produced, but information is inadequate to estimate output.
[4]For other than cement.

TABLE 2
ERITREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Eritrea Cement Works	Massawa	45,000

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The Mineral Industry of Ethiopia

By Thomas R. Yager

In 2008, Ethiopia played a significant role in the world's production of tantalum; the country's share of global tantalum mine production amounted to 9%. Other domestically significant mining and mineral processing operations included cement, crushed stone, dimension stone, and gold (Papp, 2009). Ethiopia was not a globally significant consumer of minerals.

Minerals in the National Economy

In fiscal year 2006-07 (the latest year for which data were available), the manufacturing sector accounted for 5.1% of the gross domestic product, and mining and quarrying, 0.4%. The value of output in the mining sector increased by 6% in fiscal year 2006-07. An estimated 500,000 Ethiopians were employed in artisanal mining activities (D'Souza, 2006; International Monetary Fund, 2008, p. 5).

Production

In fiscal year 2007-08, the production of soda ash increased by 458%; clay other than brick or kaolin, by 260%; gypsum, by 119%; platinum, by 100%; quartz, by 65%; silver, by 45%; ignimbrite, by 39%; peridot, by an estimated 38%; garnet, by an estimated 23%; and cement, by 13%. Granite production decreased by 45%; amethyst, by an estimated 45%; niobium (columbium) and tantalum, by 29% each; and gold, by 21% (Gebre Egziabher Mekonen, Head, Mineral Licensing and Administration Core Processes, Ethiopia Ministry of Mines and Energy, written commun., September 25, 2009).

Structure of the Mineral Industry

Mugher Cement Enterprise and Messebo Building Materials Production Share Co. were state owned; the Dire Dawa cement plant was privately owned. Gold, marble, and platinum mining companies and most salt mining companies were privately owned; kaolin, niobium (columbium), and tantalum mining companies were state owned. Artisanal miners produced clay, crushed stone, diatomite, gemstones, gold, gypsum, salt, sand, and silica sand (table 2).

Commodity Review

Metals

Gold.—Midroc Gold Mine plc (a subsidiary of Midroc Ethiopia plc) produced more than 3,000 kilograms per year (kg/yr) of gold at the Lega Dembi Mine in southern Ethiopia. The mine was expected to continue production until 2021. In 2007, Midroc discovered nearly 11,000 kilograms (kg) of new reserves at Lega Dembi; the company planned to start underground mining of the new reserves by the end of 2008. In February 2008, Midroc announced the discovery of an additional 17,000 kg of new reserves at the East Sakaro deposit in Oromia Region. Minerva Resources plc of the United Kingdom explored at Dina and Tulu Kapi in Western Wellega Region in 2008 (Minerva Resources plc, 2008; Zenebe, 2008c).

Iron and Steel.—Rebar was produced by five domestic companies; Abyssinia Integrated Steel plc was the leading producer. In late 2008, national demand for rebar was estimated to be 400,000 metric tons per year (t/yr), of which 120,000 t/yr was attributable to the Government's housing development program (Alemayehu, 2008).

Niobium (Columbium) and Tantalum.—In 2008, the Kenticha Mine was producing columbite-tantalite at the rate of about 83 t/yr. The mine was expected to produce 210 t/yr after the completion of a plant expansion at the end of 2008 (Ethiopia Ministry of Mines and Energy, 2007, p. 32).

Platinum-Group Metals.—Minerva Resources produced small amounts of gold and platinum at the Yubdo Mine in Western Wellega Region. In 2008, the company was engaged in a feasibility study on increasing platinum production to nearly 1,600 kg/yr (Minerva Resources plc, 2008).

Industrial Minerals

Cement.—Domestic cement production amounted to 1.83 million metric tons (Mt) in late 2008. Ethiopia's cement demand was estimated to be 4 million metric tons per year (Mt/yr), of which 1.2 Mt/yr was attributable to the Government's housing development program. Other projects that contributed to shortages of cement included dams for irrigation and hydroelectric power, irrigation canals, and new roads (Alemayehu, 2008).

Mugher Cement Enterprise was engaged in an expansion of the capacity of its Mugher plant to 2.2 Mt/yr from 900,000 t/yr; the project was expected to be completed by March 2009 at a cost of nearly $138 million. In August 2008, Mugher was unlikely to finish the project on time because of a lack of funds. National Cement Share Co. planned to increase capacity at the Dire Dawa plant to 230,000 t/yr from 150,000 t/yr by mid-2008. The company also planned to build a new plant with a capacity of 750,000 t/yr near the Dire Dawa plant by July 2010. Cement was also produced by Messebo Building Materials Production Share Co., which had a capacity of 900,000 t/yr; Jema Cement plc, 120,000 t/yr; and Abyssinia Cement plc, 110,000 t/yr (Ethiopian News Agency, 2008; Zenebe, 2008d).

In August 2008, Derba Midroc Cement plc started production at a new cement plant near Dejen with a capacity of nearly 150,000 t/yr. Derba Midroc planned to build another plant with a capacity of 2.5 Mt/yr near Chancho by March 2009. The cost of the plant and related infrastructure was estimated to be about $350 million. In October 2008, the company was forced to delay commissioning until February 2010. Habesha Cement Share Co. planned to complete a new plant at Holeta with a capacity of about 1.2 Mt/yr in late 2010; the cost was estimated to be about $125 million (Fekade, 2008; Zenebe, 2008a, b).

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Gypsum, Sand and Gravel, and Stone, Crushed.—Ethiopia quarried numerous types of stone for use in construction that included basalt, granite, ignimbrite, limestone, marble, pumice, rhyolite, sandstone, and scoria. Domestic consumption of gravel was estimated to be 20 million cubic meters, of which 6 million cubic meters was attributable to the Government's housing development program. National Cement's new plant was expected to consume between 240,000 and 480,000 t/yr of gypsum and pumice (Alemayehu, 2008; Ethiopian News Agency, 2008).

Potash.—In September 2008, Allana Resources Inc. of Canada acquired the Dallol potash deposits in the Danakil Depression in northeast Ethiopia. Allana estimated that inferred resources at Dallol were 105 Mt at a grade of 20.8% potassium chloride (KCl) (Allana Resources Inc., 2008).

Silica.—In March 2008, CGC Overseas Construction Ethiopia Ltd. of China signed an agreement with the Ministry of Mines and Energy to mine silica sand near Lemi in Amhara Region. The company expected to produce an average of about 180,000 t/yr of silica sand during the next 20 years as raw material for its planned new glass factory (Yewondwossen, 2008).

Mineral Fuels

Coal.—In March 2008, Derba East Africa Coal Mining plc (a joint venture of Derba Midroc Cement plc and East Africa Holdings) announced plans to mine more than 1 Mt/yr of coal in Oromia Region. The company planned to supply the Derba Midroc and National Cement plants initially; other cement plants and glass and bottle manufacturers were likely to be supplied subsequently (Chebud, 2008).

Petroleum.—Trans Global Petroleum Inc. of the United States acquired an exploration permit in Afar Region in March 2008. In late August, Titan Resources Corp. of the United States acquired Blocks 1, 5, 10, and 14 in the Ogaden Basin, and five blocks in the Abay Basin. Falcon Petroleum Ltd. of Cyprus signed a production-sharing agreement for Blocks AB1, AB4, and AB7 of the Abay Basin in August. Victoria Oil & Gas plc purchased Falcon in October. Lundin Petroleum AB of Sweden held Blocks 2, 6, 7, and 8 in the onshore Ogaden Basin (Africa Energy Intelligence, 2008).

Outlook

The production of gold, niobium, platinum, silica sand, silver, and tantalum is likely to increase in the near future; coal production is likely to start. In the next few years, cement and steel products demand was expected to increase sharply because of Government plans to build new houses, hydroelectric dams, and roads. Cement production increases were likely to be limited by capacity constraints in 2009. By the end of 2010, cement production capacity could increase by nearly 5.8 Mt/yr. The production of gypsum and pumice was expected to increase because of higher demand from cement plants; output of other construction materials was also likely to increase (Alemayehu, 2008).

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TABLE 1
ETHIOPIA: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007[e]	2008
Cement, hydraulic		1,315,934	1,568,624	1,731,000 [r]	1,625,560 [r, 4]	1,834,000
Clays:[5]						
Brick[e]		106,609 [4]	120,000	120,000	130,000	130,000
Kaolin, China clay		4,251	3,726	1,641	1,400 [r, e]	1,275
Other clay[e]	cubic meters	30,000	33,000	33,000	50,000 [r, 4]	180,000 [5]
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	70,730	92,500	108,900	116,500 [r, 4]	82,540
Nb content	do.	7,100	9,300	11,000	11,700 [r, 4]	8,300
Ta content	do.	37,000 [r]	49,000 [r]	57,000 [r]	52,000 [r, 4]	37,000
Diatomite		2,000	420 [r]	-- [r]	-- [r]	-- [e]
Feldspar		361	445	478	459 [r, 4]	424
Gemstones:[6]						
Amethyst	kilograms	1	1	43	20 [r]	11
Aquamarine	do.	2	2 [e]	2	1 [r]	--
Emerald	do.	1	1 [e]	--	1 [r]	2
Garnet	do.	11	15 [r, e]	20	30 [r]	37
Opal	do.	370	496	516	522 [r, 4]	482
Peridot	do.	--	--	4	8 [r]	11
Quartz	do.	469	250 [r, e]	31	33 [r]	35 [e]
Sapphire	do.	1	1 [r]	--	-- [r]	--
Tourmaline[e]	do.	5	3 [r]	1 [4]	2 [r]	3 [4]
Gold, mine output, Au content[6]	do.	3,443	4,376	4,028	4,368 [r, 4]	3,465
Gypsum and anhydrite, crude		51,200	34,729	38,809 [r]	72,000 [r, 4]	158,000
Lime[e]		3,800 [4]	3,800	3,800	4,000	4,000
Platinum, mine output, Pt content[7]	kilograms	--	--	4 [r, e]	5 [r, 4]	10
Quartz		170	99	40	72 [r, 4]	119
Salt, rock		200,000	87,354	218,000	240,000 [r]	260,000 [e]
Silver, mine output, Ag content	kilograms	1,133	886	902 [r]	707 [r, 4]	1,026
Soda ash, natural		6,444	8,207	4,100 [e]	286 [4]	1,597
Steel:[e]						
Crude		30,000	60,000	60,000	110,000	110,000
Semimanufactured		70,000	110,000	110,000	200,000	200,000
Stone, sand and gravel:[5]						
Basalt:						
Construction stone		477,100	651,700	1,029,000	1,205,000 [r, 4]	1,146,000
Other		18,700	52,900	57,700	61,000	61,000
Dolomite		2,250	2,148	12,812	5,653 [r, 4]	81,889
Granite	square meters	19,499	16,000 [r, e]	12,000 [r, e]	8,411 [r, 4]	4,591
Ignimbrite	cubic meters	229,277	258,829	204,516	250,938 [r, 4]	350,000
Limestone:						
Slab/tiles	square meters	3,078	2,000 [r, e]	1,000 [r, e]	338 [r, 4]	358
Other	thousand metric tons	2,380	1,635	1,750 [e]	1,900	1,900
Marble:						
Slab/tiles	square meters	122,008	90,000 [r, e]	60,000 [r, e]	32,700 [r, 4]	33,657
Terrazzo[e]	do.	114,446 [4]	120,000	120,000	130,000	130,000
Block and other[e]		14,600 [4]	22,000	22,000	23,000	23,000
Pumice		270,994	255,334	255,622	22,000 [r, 4]	35,000
Rhyolite[e]		20,700 [4]	22,000	22,000	23,000	23,000
Sand	thousand metric tons	490 [e]	312	810	842 [r, 4]	774
Sandstone[e]	do.	1,221 [4]	1,300	1,300	1,400	1,400
Scoria[e]		85,000	68,351 [4]	133,706 [4]	140,000	140,000
Silica sand		4,550	5,100 [r, e]	5,700 [r, e]	6,302 [r, 4]	6,546

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto. -- Zero.
[1]Includes data available through March 18, 2010.
[2]Data are for the Ethiopian Calendar Year ending July 7 of the year listed, except for steel.
[3]In addition to the commodities listed, some lignite, sulfuric acid, and talc reportedly were produced, but information is inadequate to estimate output.
[4]Reported figure.
[5]When reported as volume or pieces, conversions to metric tons are estimated.
[6]Does not include smuggled artisanal production.
[7]Yubdo Mine only. Platinum was also reportedly contained in gold ingots from the Lega Dembi Mine, but information is inadequate to estimate output.

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TABLE 2
ETHIOPIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Caustic soda		National Mining Corp. plc (Government owned)	Plant at Ziway	10,000.
Cement		Mugher Cement Enterprise (Government owned)	Plant at Mugher	900,000.
Do.		do.	Plant at Addis Ababa[1]	120,000.
Do.		Messebo Building Materials Production Share Co. (Government owned)	Plant at Mekele	900,000.
Do.		National Cement Share Co.	Plant at Dire Dawa	230,000.
Do.		Derba Midroc Cement plc	Plant at Dejen	150,000.
Do.		Jema Cement plc	Plant In North Shoa Zone	120,000.
Do.		Abyssinia Cement plc	Plant at Chantcho	110,000.
Glass		Addis Ababa Bottle and Glass Share Co.	do.	8,000.
Gold		Midroc Gold Mine plc (subsidiary of Midroc Ethiopia plc)	Mine at Lega Dembi	1,500,000 ore processing.
Do.	kilograms	do.	do.	4,300 gold.
Kaolin		Ethiopian Mineral Resources Development Enterprise (Government owned)	Mine at Bamba Wuha	15,000.
Marble		Ethiopian Marble Industries	Mines at Harar and various sites in western Ethiopia	NA.
Do.		National Mining Corp. (subsidiary of Midroc Ethiopia plc)	Mine at Boka	NA.
Do.	square meters	do.	Plant at Awash	250,000.
Do.		Saba Stones	Mine in Tigre Province	NA.
Niobium (columbium) and tantalum	kilograms	Ethiopian Mineral Development Share Company (Government owned)	Kenticha Mine near Borena	79,000 tantalum; 18,000 niobium.
Platinum	do.	Minerva Resources plc	Mine at Yubdo	10.[e]
Salt		Afar Salt Production Share Co. (Government owned)	Mine at Afdera Lake	50,000.
Do.		Artisanal miners	Mines at Afdera Lake	NA.
Soda ash		National Mining Corp. plc	Mine at Lake Abiyata	20,000.[e]
Steel:				
Crude		Abyssinia Integrated Steel plc	Plant at Debre Zeit	150,000.[e]
Do.		Sheba Steel Mills plc	do.	20,000.[e]
Do.		Ethiopia Steel Smelting Enterprise (Government owned)	NA	7,000.
Semimanufactured		Abyssinia Integrated Steel plc	Plant at Debre Zeit	150,000.
Do.		Zuquala Steel Rolling Mill Enterprise (Government owned)	do.	36,000.
Do.		Wallia Steel Factory	NA	36,000.
Do.		Sheba Steel Mills plc	Plant at Debre Zeit	20,000.
Do.		Ethiopia Steel Smelting Enterprise	NA	7,000.
Galvanized		Akaki Metal Products Factory	Plant at Akaki	NA.
Stone, crushed		CGC Overseas Construction Ethiopia	Plant at Addis Ababa	930,000.[e]
Sulfuric acid		Melkasa Aluminum Sulfate and Sulfuric Acid Factory	Plant at Melkasa	NA.

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating at the end of 2008.

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The Mineral Industry of Gabon

By Omayra Bermúdez-Lugo

Gabon's mineral industry was dominated by the production of crude petroleum and manganese. In 2008, the country ranked 4th among the world's leading producers of manganese, accounting for about 11% of world production. Crude petroleum production accounted for 51% of the country's gross domestic product compared with 49.4% in 2007. Other nonfuel mineral commodities produced in the country included cement, diamond, and gold. Identified mineral resources included iron ore, niobium (columbium), and phosphate rock (International Monetary Fund, 2009, p. 14).

Government Policies and Programs

Gabon was one of the first countries to commit to the Extractive Industries Transparency Initiative (EITI), which is a voluntary global compact established in 2002 that is aimed at strengthening good governance by improving economic transparency and accountability in the mining sector. The Government of Gabon began adopting and implementing the EITI principles in May 2004 by putting into place a tripartite multistakeholder group consisting of representatives from nongovernmental organizations (NGOs), the Government, and mining companies. Gabon published an annual report for the EITI that showed the revenues the Government received from companies engaged in the country's mining sector. In early January 2008, however, the Government announced the suspension of 22 Gabonese NGOs operating in the country, including the groups that comprised the Publish What You Pay (PWYP) Gabon coalition. PWYP was a global coalition that campaigned for transparency in the management of oil, gas, and mining revenues. The Government's suspension of the 22 NGOs was eventually lifted in mid-January (Extractive Industries Transparency Initiative, 2008; Reuters Africa, 2008).

Production

Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Mineral Trade

Gabon's exports to the United States were valued at about $2.3 billion in 2008 compared with $2.2 billion in 2007 and $1.4 billion in 2006. About $2.2 billion of these exports was from crude petroleum, $85.2 million was from nonferrous metals, and $3.7 million was from petroleum products. Imports from the United States were valued at about $284 million in 2008 compared with about $478 million in 2007 and $135 million in 2006. These included nearly $152 million worth of drilling and oilfield equipment; $4.7 million worth of petroleum products; $3.0 million worth of excavating machinery; $1.7 million worth of coal and other fuels; and $1.6 million worth of iron and steel products (U.S. Census Bureau, 2009a, b).

Commodity Review

Metals

Gold.—SearchGold Resources Inc. of Canada, through its subsidiary Ressources Golden Gram Gabon SARL (REG), continued with its exploration and development program for the Bakoudou-Magnima gold project. In 2008, the company completed a feasibility study for the project's first target area known as Zone A. Measured and indicated resources in Zone A were reported to be about 2.4 million metric tons (Mt) at an average grade of 3.01 grams per metric ton gold. A mining license for the Bakoudou-Magnima project was granted to SearchGold in September 2008. The company planned to build an open pit mine and produce about 1,200 kilograms per year (reported as 40,000 troy ounces per year) of gold for a period of 3.5 years (SearchGold Resources Inc., 2008; 2009, p. 2-5).

Iron Ore.—China National Machinery and Equipment Import & Export Corp. (CMEC) continued with its plan to develop the 500-Mt Belinga iron ore deposit, which is located about 500 kilometers (km) east of Libreville in Ogooue-Ivindo Province. On May 24, the company signed a mining agreement with the Government that provided for the construction of major infrastructure at Belinga, including a new 560-km-long extension to the Trans-Gabon railway that would be used to transport iron ore from the proposed mine to a deepwater port in Santa Clara. Other infrastructure projects included the construction of two hydroelectric powerplants to supply electricity to the mine. The development of the Belinga Mine and associated infrastructure was expected to be completed between 2011 and 2012 and to cost about $5 billion. The envisioned iron ore production capacity of the mine was estimated to be between 20 million metric tons per year (Mt/yr) and 30 Mt/yr (Africa Mining Intelligence, 2008; Gide Loyrette Nouel, 2008; Steel Guru, 2008).

Manganese.—Compagnie Minière de l'Ogooué S.A. (Comilog), which was a subsidiary of Eramet International of France, mined manganese deposits at Bangombe and operated the Moanda open pit mine. In 2008, the company completed a 4-Mt/yr expansion project for Moanda, which included an environmental plan to address the buildup of discharges into the Moulili River by enriching and reusing fine ore material. In addition to the production expansion at Moanda Mine, Comilog also worked on the refurbishing of 30 km of track of the Trans-Gabon railway and studied the possibility of building a new manganese and silicomanganese metal production plant in the country. Comilog, which also managed the Trans-Gabon railway, held a 75% interest in Moanda Mine; the remaining 25% was held by the Government (Eramet S.A., 2009, p. 22-24, 47).

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Mineral Fuels and Related Materials

Petroleum.—Total S.A. held exploration and production operations in Gabon through two locally incorporated companies, Total Gabon S.A. and its subsidiary, Total Participations Pétrolières Gabon. In 2008, Total began the redevelopment of the Anguille oilfield, which is located about 20 km offshore Port-Gentil. The first phase of the project, which began in 2007, included the drilling of thirteen wells. Phase 2, which was to begin in 2009, would include the installation of new offshore infrastructure, the decommissioning of obsolete processing units, the construction of an onshore power generation plant, and the drilling of at least 30 wells. Production from the Anguille oilfield was expected to reach 30,000 barrels per day by 2014 (Total S.A., 2008; 2009, p. 13, 30-31).

Houston-based VAALCO Energy Inc. (VAALCO) operated in Gabon through its two subsidiaries, VAALCO Gabon (Etame) Inc. and VAALCO Production (Gabon). The company produced petroleum from the Avouma, the Ebouri, the Etame, and the South Tchibala oilfields, which are located within the Etame Marin Block offshore Gabon. During 2008, the Avouma, the Etame, and the South Tchibala fields produced a combined 7.8 million barrels of petroleum. The Ebouri oilfield, which was discovered in 2004, had a platform installed in August 2008. The first development well at Ebouri was drilled in late 2008. In November, drilling began on the first of three planned exploration wells. The first of these wells, the North Ebouri, encountered substantial oil-filled Gamba sandstone, reportedly indicating the existence of significant additional reserves north of the originally mapped field development outline. The second well, the North Etame prospect, encountered water-bearing sands and was abandoned. The third prospect, the South East Etame, was scheduled to be drilled during the second or third quarter of 2009. Onshore Gabon, VAALCO held a 100% working interest in the Mutamba Iroru Block located near the coast in central Gabon. The company acquired aeromagnetic gravity data in 2008, and together with seismic data acquired from previous operators in 2006 and 2007, began to drill two exploration wells on the block. All VAALCO's crude oil production in Gabon was sold to Total Oil Trading SA. As of December 31, 2008, VAALCO owned a 30.35% interest in the exploration acreage within the Etame Marin Block and a 28.1% interest in the development areas surrounding the Avouma, the Etame, and the South Tchibala oilfields (VAALCO Energy Inc., 2009, p. 2-6, 18).

Uranium.—During 2008, the joint-venture of Canadian companies Cameco Corp., Motapa Diamonds Inc., and Pitchstone Exploration Ltd. conducted a sampling, geologic mapping, and prospecting program and completed a helicopter-borne electromagnetic survey for the Oklo-Mounana uranium property. The purpose of the program was to follow up on identified anomalous areas within the property and to obtain information that would help prioritize target areas. A total of 338 stream sediment samples and 326 rock samples were collected and analyzed. The company's 2009 exploration plans for Oklo-Mounana were under review as of yearend (Pitchstone Exploration Ltd., 2009, p. 12-13, 19).

Outlook

If plans to develop the Belinga Mine come to fruition, Gabon would rank among the world's top 20 producers of iron ore within the next 4 to 5 years. The Government is likely to benefit from revenues from the Belinga Mine and from ongoing expansions at the Moanda manganese mine in the near future. The country's weak infrastructure is likely to be revamped in the next 5 years if proposed infrastructure developments, which include the construction of roads, railroads, a deepwater port, and hydroelectric powerplants, come to fruition as part of the planned investments in the mineral industry.

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TABLE 1
GABON: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

Commodity[3]		2004	2005	2006	2007	2008
Cement and clinker:						
Cement, hydraulic[4]	metric tons	260,000	260,000	260,000	228,601 [5]	230,000
Clinker	do.	350,000	350,000	350,000	185,109 [5]	190,000
Diamond, gem and industrial	carats	500	500	500	500	500
Gold, mine output, Au content	kilograms	300	300	300	300	300
Manganese:						
Metallurgical-grade ore, gross weight (50% to 53% Mn)	thousand metric tons	2,400	2,800	2,925 [5]	3,200	3,250 [5]
Pellets, battery- and chemical-grade, gross weight (82% to 85% MnO_2)	do.	60	59	75	100	100
Total	do.	2,460 [5]	2,859 [5]	3,000 [5]	3,300 [5]	3,350
Natural gas, gross	million cubic meters	80	80	80	80	80
Petroleum:						
Crude	thousand 42-gallon barrels	87,235 [5]	85,469 [5]	84,738 [5]	84,008 [5]	85,775 [5]
Refinery products	do.	6,300	6,000	6,000	6,000	6,000

do. Ditto.
[1]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through October 9, 2009.
[3]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is also produced, but output is not reported, and available information is inadequate to make reliable estimates of output.
[4]Includes cement produced from imported clinker.
[5]Reported figure.

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TABLE 2
GABON: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and and major equity owners	Location of main facilities	Annual capacity
Cement		Société des Ciments du Gabon (HeidelbergCement Group through Scancem International ANS, 75% and Government, 25%)	Cement-grinding plant at Owendo, south of Libreville	240,000.
Do.		do.	Cement-grinding plant at Franceville, southeastern Gabon	170,000.
Clinker		do.	Clinker plant at N'Toum, 40 kilometers east of Libreville	300,000.
Gold	kilograms	Artisanal miners	Eteke region	300 to 700.
Manganese		Compagnie Minierè de l'Ogooué S.A. (Comilog) (Eramet International, 67%; Government, 25%; other, 8%)	Open pit mine at Moanda	4,000,000 ore, gross weight.
Do.		do.	Sintering plant	600,000.
Petroleum:				
Crude	thousand 42-gallon barrels	Total Gabon S.A., 100%	Anguille	NA.
Do.	do.	Total Gabon S.A., 40%	Atora	NA.
Do.	do.	Total Gabon S.A., 57.5%	Avocette	NA.
Do.	do.	Total Gabon S.A., 50%	Baudroie Nord	NA.
Do.	do.	Total Gabon S.A., 100%	Gonelle	NA.
Do.	do.	Total Gabon S.A., 47.5%	Rabi Kounga	NA.
Do.	do.	Total Gabon S.A., 100%	Torpille	NA.
Do.	do.	PanAfrican Energy, 33.90%; Vaalco Gabon (Etame) Inc., 30.35%; Sasol Petroleum International, 30%; Sojitz Corp., 3.225%; Petro Energy Resources Corp., 2.525%	Etame Marine Block, offshore, including: Avouma oilfield	2,400.
Do.	do.	do.	South Tchibala	NA.
Do.	do.	do.	Ebouri oilfield (exploration stage)	NA.
Do.	do.	do.	Etame oilfield	6,570.
Do.	do.	Marathon Oil Corp., 56%; Tullow Oil plc, 25%; Devon Energy Corp. (% ownership unknown)	Tchatamba Marin oilfield	NA
Do.	do.	do.	Tchatamba West oilfield	NA.
Do.	do.	do.	Tchatamba South oilfield	NA.
Do.	do.	PanOcean Energy Corp., operator, 92.5%	Obangue oilfield	1,800.
Do.	do.	do.	Tsiengui oilfield	1,800.
Do.	do.	PanOcean Energy Corp., operator, 90%	Remboue oilfield	NA.
Do.	do.	PanOcean Energy Corp., 31.4%	Etame Marin oilfield	2,300.
Refinery products	do.	Société Gabonnaise de Raffinage (Total Gabon S.A., 58%; Government, 25%; other, 17%	Port Gentil	8,800.

Do., do. Ditto. NA Not available.

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The Mineral Industries of The Gambia, Guinea-Bissau, and Senegal

By Omayra Bermúdez-Lugo

THE GAMBIA

Mining in The Gambia was limited to the production of clay, laterite, silica sand, and zircon, and did not play a significant role in the country's economy. The Department of State for Trade, Industry, and Employment was the Government entity responsible for the administration of the mining sector. The country did not produce petroleum and depended upon imports to meet its domestic energy requirements.

Production

Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Titanium, Titanium Dioxide, and Zircon.—In January 2008, the Government of the Gambia announced the suspension of the mining license it had granted to Carnegie Minerals plc for the mining of mineral sands at the Batukunku, the Kartung, and the Sanyang deposits in Brufut. Carnegie Minerals was a subsidiary of Carnegie Corp. Ltd. of Australia, which in 2002 had acquired the rights to mine ilmenite, rutile, and zircon in joint venture with Astron Ltd., an Australian company based in Shenyang, China. The Government allegedly decided to suspend the company's mining license, stating that Carnegie Minerals was exporting minerals other than those outlined within its mining contract. Carnegie Minerals denied the allegations. No arbitration on the case was reported as of yearend (Allen, 2008; BBC News, 2008; U.S. Department of State, 2009).

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GUINEA-BISSAU

Mining in Guinea-Bissau was limited to small-scale production of construction materials, such as clay, granite, limestone, and sand and gravel, but information was inadequate to make reliable estimates of output. The country's prospective mineral resources included bauxite, diamond, gold, heavy minerals, petroleum, and phosphate rock. Guinea-Bissau did not produce petroleum and depended upon imports to meet its domestic energy requirements.

Commodity Review

Metals

Bauxite and Alumina.—Bauxite Angola S.A. (a company that was partly owned by the Government of Angola) planned to invest $500 million to develop a bauxite mine in Guinea-Bissau. The company held under concession the Boe bauxite deposits, which are located in the region of Boe about 240 kilometers (km) from Bissau. Measured resources were estimated to be 113 million metric tons (Mt) at average grades of 44% Al_2O_3 and 3.7% SiO_2. Once developed, the mine was expected to produce about 2 million metric tons per year (Mt/yr) of bauxite ore. The company, which paid an up-front fee of $13 million to Guinea-Bissau, also planned to construct a deepwater port at Buba and a road to connect the mine to the port facilities. The company also was studying the possibility of constructing an alumina plant in Guinea-Bissau to process the ore. A pilot plant was expected to be operational by 2011 (Bauxite Angola S.A., 2008; Fletcher, 2008; Macauhub, 2008a, b).

Industrial Minerals

Phosphate Rock.—In September, the Government revoked GB Phosphate Mining Ltd.'s (GBPM) mining contract for the Farim phosphate rock deposit, which is located about 100 km northeast of the capital city of Bissau. The Government stated that the company had failed to meet its contractual obligations, including failing to notify the Directorate of Geology of the temporary suspension of the company's activities between December 2007 and February 2008, failing to provide a financial guarantee to the Government prior to engaging in mining activities, and conducting the unauthorized transfer of mining rights to GBPM's parent company, GB Mining Holding AG of Switzerland. GBPM had reportedly invested about $15 million in the project and had completed a prefeasibility study for the Farim deposit (Africa 21, 2008; Dabo, 2008; Expresso Sojornal S.A., 2008).

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SENEGAL

Phosphate rock production, which was processed and converted to phosphoric acid, dominated Senegal's mining sector. Other mineral commodities produced in the country were basalt, cement, clays, gold, laterite, lime, limestone, natural gas, petroleum, salt, and sand.

Production

Data on mineral production are in table 1. Phosphoric acid prduction decreased by 23% to 180,000 metric tons (t) from 234,000 t in 2007.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—Most gold mining activities in Senegal were concentrated around the Sabodala gold district, which is located to the northeast of the country. AXMIN Inc. (AXMIN), IAMGOLD Corp. (IAMGOLD), and Oromin Explorations Ltd. (Oromin) of Canada; Mineral Deposits Ltd. (MDL) of Australia; and Randgold Resources Ltd. (Randgold) of the United Kingdom continued to explore for gold during the year.

MDL was in the process of developing the Sabodala open pit gold mine, which was expected to produce its first commercial gold in early 2009. Sabodala Mine was expected to produce about 5,300 kilograms per year (kg/yr) during the first year of operation and an average of about 4,700 kg/yr (reported as 150,000 troy ounces) for the remainder of the mine's life. The project would include a carbon-in-leach processing plant with a design throughput capacity of 2 Mt/yr. MDL, which planned to employ more than 500 Senegalese nationals at the mine, held a 90% interest in the project and the Senegalese Government held the remaining 10% free-carried interest. As of November 18, 2008, measured and indicated resources at Sabodala were reported to be 42.1 Mt at a cutoff grade of 0.65 gram per metric ton (g/t) and an average grade of 1.84 g/t gold. During 2008, at least 2.1 Mt of waste and more than 500,000 metric tons of ore were mined and stockpiled at the crusher ready for plant startup. More than 1,200 kilograms of gold (reported as 40,000 troy ounces) was stockpiled. MDL anticipated that the processing plant would be completed by mid-January 2009 and that the rampup to commercial production rates would commence immediately thereafter. The company anticipated reaching full production levels by late February or March 2009 (Mineral Deposits Ltd., 2008a, p. 4-11; 2008b, c).

Randgold continued to explore for gold at its Massawa concession, which is located in southern Senegal. During the course of the year, a total of 58 diamond drill holes were drilled to evaluate the Massawa target further and delineate the geometry of gold mineralization. A scoping study was underway, and the company planned to conduct a prefeasibility study depending on the preliminary results obtained from the scoping study (Randgold Resources Ltd., 2009, p. 37-39).

Iron and Steel.—Luxembourg-based ArcelorMittal planned to invest more than $2 billion for the construction of an iron ore mine in southeastern Senegal despite a court appeal from South Africa's Kumba Iron Ore Ltd. contesting the rights to the mine. ArcelorMittal planned to produce between 15 Mt/yr and 25 Mt/yr of iron ore beginning in 2011 and to build port facilities near Dakar and a 750-km railway line to link the mine to the port facilities (Magnowski, 2008; Roelf, 2008).

Titanium, Titanium Mineral Concentrates, and Zircon.—MDL continued to work on the development of the Grande Côte Mineral Sands Project (GCMSP). The GCMSP consisted of a series of deposits within a 2-km-wide and 80-km-long sand dune system that runs along Senegal's coastline about 50 km northeast of the capital city of Dakar. Inferred mineral resources were estimated to be 1.33 billion metric tons at an average grade of 2% heavy minerals. The deposits are composed of free-flowing sand with little to no slimes and are considered suitable for mining by low-cost dredging methods. MDL planned to produce about 650,000 metric tons per year (t/yr) of ilmenite, 85,000 t/yr of zircon, and smaller amounts of leucoxene and rutile. The company completed a drilling program during the first half of the year and planned to complete a new resource and reserve estimate for the GCMSP by the second quarter of 2009. A detailed engineering and construction plan for the mine was also underway, and a mine dredge pump was expected to be delivered at the mine site in early 2009 (Mineral Deposits Ltd., 2008a, p. 7, 12-14; 2008d).

Industrial Minerals

Phosphate Rock.—Industries Chimiques du Sénégal (ICS) was Senegal's phosphate rock mining and processing company. The Government of India, through Indian Farmers Fertilizer Cooperative Ltd. (IFFCO), and Senegal were equity partners in ICS (table 2). Phosphate ore was mined from the Keur Mor Fall and the Tobene deposits within the Taiba Mine. Part of

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the marketable phosphate rock was sent to ICS's phosphoric acid plants in Darou Khoudoss, and the remaining was sent to the Dakar Port for export. The facilities at Darou consisted of two adjacent phosphoric acid production plants that had a combined production capacity of 660,000 t/yr of P_2O_5. Most of the phosphoric acid produced was exported to India (Industries Chimiques du Sénégal, 2008).

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TABLE 1

THE GAMBIA AND SENEGAL: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Country and commodity		2004[e]	2005[e]	2006[e]	2007	2008
THE GAMBIA[2]						
Clay[3]	metric tons	13,655 [4,5]	13,700	13,700	6,713 [r,4]	NA [4]
Ilmenite		--	--	--	672 [r,4]	-- [4]
Laterite[3]		245 [4,5]	250	250	187 [r,4]	115 [4]
Silica sand[3]		1,389 [4,5]	1,390	1,390	712 [r,4]	1,065 [4]
Zircon/rutile concentrate	metric tons	-- [4,5]	--	410 [5,6]	355 [r,4]	-- [4]
SENEGAL[7,8]						
Basalt[3]	metric tons	360	360	360	400 [e]	979 [p]
Cement, hydraulic		2,391 [5]	2,623 [5]	2,884 [5]	3,152	3,084
Clay[3]	metric tons	20	20	20	--	--
Clays, fuller's earth (attapulgite)		200	127 [5]	140 [5]	150 [e]	167
Gold, mine output, Au content[e,9]	kilograms	600	600	600	600	600
Laterite[3]	metric tons	300	300	300	300 [e]	63 [p]
Lime		NA	NA	NA	NA	82
Limestone[3]	metric tons	1,600	1,600	1,600	1,600 [e]	1,006 [p]
Natural gas[e]	thousand cubic meters	12,600	12,600	12,600	12,600	12,600
Petroleum:[10]						
Crude oil	thousand 42-gallon barrels	202 [5]	374 [5]	388 [5]	317	99 [p]
Refinery products	thousand metric tons	1,106 [5]	870 [5]	313 [5]	648	896
Phosphate rock and related products:[11]						
Calcium phosphate-based fertilizers[12]		210 [5]	186 [5]	33 [5]	82	50
Crude rock:						
Aluminum phosphate		4	4	4	4 [e]	4
Calcium phosphate[12]		1,576 [5]	1,451 [5]	584 [5]	691	645
Phosphoric acid, P_2O_5 content		570 [5]	504	180 [5]	234	180
Salt		168 [5]	134 [5]	199 [5]	212	241
Sand[3]	metric tons	2,170	2,170	2,170	2,200 [e]	6,421

[e]Estimated; estimated data are rounded to no more than three significant digits. [p]Preliminary. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through October 6, 2009.

[2]In addition to the commodities listed, The Gambia also produced a variety of construction materials (laterite, sand, and shell), but information is inadequate to make reliable estimates of output.

[3]Values converted from cubic meters to metric tons. Specific gravity, in grams per cubic meter—basalt, 2.8; clay, 2.55; laterites, 2.55; limestone, 2.6; and sand, 2.6.

[4]Source: Geology Department of the Republic of The Gambia.

[5]Reported figure.

[6]From sales.

[7]In addition to the commodities listed, Senegal also produced sand and gravel, and stone for local construction purposes, but information is inadequate to make reliable estimates of output.

[8]Source: Direction des Mines et de la Géologie, Republic of Senegal. The major source of information for the Senegal 2006 figures is Agence National de la Statistique et de la Démographie.

[9]Government estimate of unreported production of artisanal gold.

[10]Crude petroleum values have been converted from metric tons to 42-gallon barrels using a conversion factor of 7.4 barrels of crude petroleum per metric ton.

[11]Industries Chimiques du Sénégal was the main producer of phosphate rock in Senegal. Phosphate rock production excludes about 200,000 metric tons per year, which is estimated to be produced from other Senegalese sources.

[12]Source: Industries Chimiques du Sénégal.

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TABLE 2
THE GAMBIA AND SENEGAL: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Thousand metric tons)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
THE GAMBIA			
Zircon/rutile concentrate[1]	Carnegie Minerals plc and Astron Ltd.	Sanyang district	20.
SENEGAL			
Attapulgite	Senegal Mines (Government, 49%, and private, 51%)	240 kilometers south of Dakar	100.
Do.	Société Senegalaise de Phosphates de Thies SA (private, 100%)	Lam Lam	NA.
Cement	Les Ciments du Sahel S.A. (private, 100%)	Kirene plant	600.
Do.	Société Ouest Africaine des Ciments (private 100%)	Rufisque plant	2,000.
Petroleum products	Total S.A. (54%), Royal Dutch Shell plc (23%), Exxon Mobil Corp. (13%), Government (10%)	Refinery, 23 kilometers from Dakar	1,226.
Phosphate rock, calcium	Industries Chimiques du Sénégal Group (ICS) (Archean Group, Government of India, and Indian Farmers Fertilizer Cooperative Ltd., (IFFCO), 85%, and Government of Senegal, 15%)	Taiba Mine, 50 kilometers from Dakar	2,000.
Do.	Société Senegalaise de Phosphates de Thies SA (private, 100%)	Lam Lam, Sebikhotane, and Allou-Kagne	NA.
Phosphoric acid	Industries Chimiques du Sénégal Group (Indian Farmers Fertilizer Cooperative Ltd., 85%, and Government 15%)	Darou I plant, Darou Khoudoss	660 P_2O_5.

Do. Ditto. NA Not available.
[1]Mine under development.

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The Mineral Industry of Ghana

By Omayra Bermúdez-Lugo

Gold continued to be a key industry to Ghana's economy. Information on the contribution of the mining sector to the country's gross domestic product (GDP) for 2008 was unavailable; in 2007, however, the mining sector contributed about 6.2% of the GDP, represented about 41% of export earnings, and was one of the leading contributors (14%) to the Internal Revenue Service through the payment of corporate taxes and ancillary levies, employee income taxes, and mineral royalties. Other mineral commodities produced in the country included bauxite, diamond, manganese, salt, and silver (Ghana Chamber of Mines, 2008). As of December 31, 2007, (the latest date for which data were available) direct employment by mineral-producing members of Ghana's Chamber of Mines was 12,658; 98% of those employed were reportedly Ghanaians. Small-scale mines employed about 600,000 people as of yearend 2006, and mining support services employed about 7,500 people (Ghana Chamber of Mines, 2009, p. 12, 23).

Government Policies and Programs

The legislative framework for the mining sector in Ghana is provided by the Minerals and Mining Act 703 of 2006. Under the law, all minerals are owned by the state. Under the Minerals and Mining Act, the holder of a mining lease or small-scale mining license must pay a royalty of no less than 3% and no more than 6% of their gross revenues. In the metals sector, reconnaissance licenses may be granted for an initial period not to exceed twelve months and may be extended only once for a period not to exceed an additional 12 months. A prospecting license may be granted for an initial period not to exceed 3 years and may be extended only once for a period not to exceed an additional 3 years. Upon the expiration of a reconnaissance or prospecting license, the holder may apply for a mining lease. A mining lease may be granted for an initial term not to exceed 30 years and may be extended only once for a period not to exceed an additional 30 years. The Government is entitled to a free-carried equity interest of 10% in all mineral ventures (Parliament of the Republic of Ghana, 2006, p. 12-23).

In the industrial minerals sector, reconnaissance and prospecting licenses and mining leases can be granted only to Ghanaian citizens unless the proposed investment exceeds $10 million. Small-scale mining licenses are also reserved for Ghanaian citizens only and are granted for a period not to exceed 5 years and, upon the expiration of the license, it may be renewed for a period to be determined by the Minerals Commission (MC) (Parliament of the Republic of Ghana, 2006, p. 36-40).

A Government decision to cut back on electricity subsidies for mining companies went into force on July 1. Electricity rates for mining companies increased by 100% to 22 cents per kilowatt hour from 11 cents per kilowatt hour. Mining companies pressed for a reduced increase, stating that the new electricity tariff would result in increases in operational costs, in particular for companies with underground mining operations, which are energy intensive (Kpodo, 2008a).

Airborne geophysical surveys and detailed geologic field mapping were being conducted on about one-third of Ghana's surface area with the support of the European Union under a program known as the Mining Sector Support Program (MSSP). The program was to include the development of an information management system, which would involve the development of various databases, and the creation of an intranet to link the various Government agencies involved in the mining sector, and the creation of a Ghanaian mining Web site (Ministry of Lands, Forestry and Mines, 2009a).

In 2008, the Government sponsored a 25-member delegation of small-scale Ghanaian miners to attend a 2-week study tour of the mining industry in China. The tour, which was facilitated by Shaanxi Mining Co. of China, was aimed at helping small-scale miners adopt modern and cost-effective technologies to help address environmental and health hazard issues associated with small-scale mining operations and to help the miners improve their managerial and organizational skills (Ghana MMA, 2008).

Production

Data on mineral production are in table 1.

Structure of the Mineral Industry

The Ministry of Lands, Forestry and Mines, through the MC, the Geological Survey Department (GSD), the Inspectorate Division of Minerals Commission (IDMC), and the Precious Minerals Marketing Co. Ltd. (PMMC), oversees all aspects of Ghana's mineral sector. The MC is responsible for regulating and managing the use of Ghana's mineral resources and for coordinating Government policy related to them. The GSD is responsible for the providing reliable and up-to-date geologic information and serves as the repository of the country's geoscientific data. The IDMC is responsible for instituting and enforcing health, safety, and environmental standards within the country's mines and for ensuring that mining companies and all mining-related activities comply with Ghana's mining and mineral laws and regulations through effective monitoring. The PMMC is responsible for the marketing of the country's precious minerals and jewelry industry. The National Petroleum Authority is the Government agency responsible for overseeing, monitoring, and regulating the activities in the petroleum downstream industry. Ghana National Petroleum Corp. (GNPC) is the Government-owned petroleum company in charge of exploration, development, and production of petroleum. The Volta River Authority (VRA) produced hydroelectric power from the Akosombo Dam. The VRA also obtains electricity from neighboring Côte d'Ivoire, which has intermittently experienced political instability and civil unrest. The VRA planned to increase its thermal power generation capacity by constructing

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a 126-megawatt (MW) natural gas thermal powerplant at Tema (Ministry of Lands, Forestry and Mines, 2009b).

Mineral Trade

Ghana was the United States' 101st ranked goods trading partner with about $830 million in total goods traded in 2008 and was the United States' 89th ranked goods export market and the 111th ranked supplier of imported goods. Ghana's exports to the United States were valued at about $222 million in 2008 compared with about $199 million in 2007 and $192 million in 2006; $58.9 million of these exports was from petroleum products; $3.1 million, gold; and $1.6 million, gem-quality diamond. Total imports from the United States were valued at about $608 million in 2008 compared with about $416 million in 2007 and $289 million in 2006. These included nearly $63 million for petroleum products; $53.9 million for excavating machinery; $42.7 million for drilling and oilfield equipment; and $6.2 million in specialized mining equipment (U.S. Census Bureau, 2008a, b; Office of the United States Trade Representative, 2009).

Commodity Review

Metals

Aluminum.—In June 2008, the Government acquired Alcoa Inc.'s 10% stake in Volta Aluminum Co. Ltd. (VALCO) for $2 million. With this purchase, the Government became the sole owner of VALCO. VALCO was the company that operated the country's only aluminum smelter, which is located in the city of Tema in southeastern Ghana. Shortly after the purchase, the Government sought to sell a stake in VALCO to interested partners. In November, the Ghanaian Parliament approved the sale of 70% of the company, but the foreign companies mentioned in the deal—Norsk Hydro ASA of Norway and Companhia Vale do Rio Doce of Brazil—denied that they had agreed to buy a stake in the company. The Tema smelter had been struggling with fluctuating operating levels since 2003 mostly owing to restricted power allocations from the Volta River Authority hydroelectric plant because of low water levels in the Volta River. The smelter remained closed throughout 2008. The design capacity of the smelter was 200,000 metric tons per year (Kpodo, 2008b; Murphy, 2008; Thomson and others, 2008).

Gold.—Adamus Resources Ltd. of Australia held a 90% interest in the Southern Ashanti Gold Project (SAGP), which is located in southwestern Ghana about 280 kilometers (km) west of the capital city of Accra. The project, which covers a total area of 626 square kilometers, lies about 40 km south of the Bogoso/Prestea gold mine and comprises the Anwia and the Salman gold deposits. A bankable feasibility study for the project was completed in June 2007. Measured and indicated resources were estimated to be about 28.4 million metric tons (Mt) of ore at a grade of 1.78 grams per metric ton (g/t) gold, and inferred resources were estimated to be 6.43 Mt of ore at a grade of 1.64 g/t gold. As of yearend 2008, Adamus had obtained a mining license for the project for an initial 10 years with the option to renew the term for an additional 10 years. The mine was expected to produce about 3,100 kilograms per year (kg/yr). Construction work at the mine was expected to begin in 2010 (Adamus Resources Ltd., 2009, p. 4-6).

AngloGold Ashanti Ltd. of South Africa held 100% ownership in the Iduapriem and the Obuasi gold mines. Iduapriem, which is located about 70 km north of the city of Takoradi, is an open pit mine and includes a carbon-in-pulp processing plant. The mine produced about 6,200 kilograms (kg) of gold in 2008 compared with about 5,800 kg in 2007. The increase in production was attributed to an increase in crushed tonnage owing to the commissioning of a new crusher and a marked improvement in blast fragmentation. Production at Iduapriem was projected to remain constant at about 6,200 kg in 2009. Obuasi, which is located in southern Ghana about 80 km from Kumasi, is an underground mine (although some surface mining does occur) and includes a sulfide processing plant, an oxide processing plant, and a tailings processing plant. Production at Obuasi decreased marginally to about 11,100 kg in 2008 compared with about 11,200 kg in 2007. The decrease in production was attributed to decreases in the volume processed and the grade mined, as well as to unscheduled repair and maintenance to the mill, water-quality issues, and the delay in the commissioning of a sulfide tailings plant. Production at Obuasi was projected to increase to about 12,400 kg in 2009. On October 23, the Ghanaian Parliament extended the term of the Obuasi mining lease until 2054 (AngloGold Ashanti Ltd., 2009, p. 64-67, 120).

AngloGold Ashanti continued to have clashes with artisanal miners operating illegally at the Obuasi Mine. The company reported that during 2008 there were 27 deaths and 1 injury because of landslides in the course of, in most cases, illegal artisanal mining, and the death of a person suspected of stealing fuel from a haul truck. Three people died and three community members were injured as a result of interactions with security personnel (AngloGold Ashanti Ltd., 2009, p. 136).

AngloGold Ashanti's mining operations in Ghana were dependent upon hydroelectric power from the VRA and, to a lesser extent, on a recently constructed smaller VRA thermal powerplant. To supplement the power generated by the VRA, AngloGold Ashanti, together with three other principal gold producers in Ghana (names not disclosed), acquired an 85-MW diesel-fired powerplant. The plant could be converted to gas supply once the anticipated West African gas pipeline (WAGP) is developed. AngloGold Ashanti was one of the companies negotiating with the Government to seek a reduction in electricity rates, which were raised during the year (AngloGold Ashanti Ltd., 2009, p. 167).

Gold Fields Ltd. of South Africa (71.1%) operated the Damang and the Tarkwa gold mines through a joint venture with IAMGOLD Corp. (18.9%). The Government held the remaining 10% interest in the mines. The Damang Mine is located in southwestern Ghana about 360 km west of Accra. Production at Damang is derived from several open pits, the newest of which was the Rex pit, which went into operation in 2008. Mine facilities included a carbon-in-leach plant. Production for the fiscal year that ended on June 30, 2008, was 6,041 kg compared with 5,843 kg produced in fiscal year 2007. The increase was owing to improved mill recovery to 93.8% from

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92.2% following the installation of a seventh carbon-in-leach tank and a second gravity unit. The Damang Mine employed 407 permanent employees and 1,101 contractors. The company expected to produce about 6,800 kg for the fiscal year ending on June 30, 2009, and planned to complete a pit cutback at Damang by June 30, 2013. Gold Fields reported that in April 2008, about 2,000 illegal miners invaded the Rex and the Cinnamon Bippo project areas. As a result of consultations with the district and regional security committees for assistance with evicting the illegal miners, an agreement was reached with the illegal miners during the year and these reportedly eventually abandoned the project areas (Gold Fields Ltd., 2008, p. 17, 32-35).

The Tarkwa Mine, which is located in southwestern Ghana about 300 km west of Accra, comprises several open pits, including the North (Tarkwa) and the South (Teberebie) heap-leach operations and a carbon-in-leach plant. During fiscal year 2008, the mine produced a total of 20,095 kg compared with 21,684 kg in 2007. The Tarkwa Mine had 1,805 permanent employees, 44 temporary employees, and 2,846 contractors. Mining and processing operations were curtailed early in the year by fluctuations in power supply from the national grid followed by heavy rainfall (including a once-in-50-years event) during the first two quarters and unplanned fleet down time because of a shortage of quality tires. A tire-retreading facility was commissioned during the year in an attempt to extend the life of radial heavy-duty tires. Gold production was expected to increase to 23,300 kg/yr once a mill and heap-leach pad expansion is completed. A carbon-in-leach expansion project, which was scheduled to be in full production by the end of fiscal year 2009, was expected to increase ore throughput to 1 Mt of ore per month from 400,000 metric tons (t) (Gold Fields Ltd., 2008, p. 17, 32-35).

Golden Star Resources Ltd. (Golden Star) through its subsidiary Golden Star Bogoso/Prestea Ltd. held a 90% interest in the Bogoso/Prestea and the Wassa gold mines. The Bogoso/Prestea Mine comprises the adjoining Bogoso and Prestea mining concessions, a 3.5-million-metric-tons-per-year (Mt/yr)-processing facility that used bio-oxidation technology to treat refractory sulfide ore and a 1.5-Mt/yr carbon-in-leach processing facility that treated oxide ore. Production of gold at the Bogoso/Prestea Mine increased by about 43% to 5,300 kg in 2008 compared with about 3,700 kg in 2007 mostly owing to the commissioning of the bio-oxidation plant in mid-2007. The company planned to begin mining oxide ore from the Prestea South deposit in 2009 and eventually to source oxide ore from another deposit known as Mampon. The Prestea South and the Mampon deposits are located about 20 km southeast and 35 km north, respectively, of the Bogosso processing plants (U.S. Securities and Exchange Commission, 2009, p. 16-20, 44-48).

Golden Star expected to produce about 6,200 kg of gold at the Bogoso/Prestea Mine in 2009. Golden Star, through its subsidiary Golden Star (Wassa) Ltd. (GSWL), also owned 90% of the Wassa open pit gold mine and carbon-in-leach processing plant. The Wassa Mine produced 3,901 kg in 2008 compared with 3,920 kg in 2007. GSWL also owned the Benso and the Hwini-Butre concessions in southwestern Ghana. Golden Star invested $40 million in the development of the Benso Mine in 2008. The mine began shipping ore to the Wassa processing plant in the third quarter of 2008; during the fourth quarter, it began the construction of a 30-km haul road south to the Hwini-Butre ore deposit, from which the company expected to begin mining by the second half of 2009. The Benso and the Hwini-Butre concessions are located about 50 km and 80 km, respectively, from the Wassa Mine. The mineral resource at Benso was estimated to be 800,000 t of ore at an average grade of 2.24 g/t gold and at Hwini-Butre to be 1 Mt of ore at an average grade of 3.43 g/t gold. Golden Star expected to produce about 6,200 kg from the Wassa Mine, which would include ore processed from the Benso and the Hwini-Butre deposits (U.S. Securities and Exchange Commission, 2009, p. 16-20, 44-48).

Midlands Minerals Corp. held a 100% interest in the Kaniago, the Kwahu Praso, and the Nsuta gold properties, and a 65% interest in the Sian open pit gold mine. The Sian Mine and carbon-in-leach processing plant had been in operation between 2001 and 2003 but was closed in 2004 owing to low gold prices and operational problems. The inadequate design of the pit by the former owner of the mine (Sian Goldfields of China); the lack of spare parts for the 500-metric-ton-per-day (t/d) processing plant that was brought in from China; and language barriers within the mining team were some of the operational problems cited by Midlands for the closure of the mine. The company's mining lease for the Sian Mine is valid until 2026, and indicated resources at the mine were estimated to be about 2.6 Mt of ore at an average grade of 2.33 g/t gold. The company expected to have the Sian Mine at the prefeasibility stage by the end of 2009 and to reach a production decision stage by the end of 2010. Midlands planned to integrate the Sian and the Kwahu Praso properties, given that Kwahu Praso is contiguous to and was once part of the Sian Mine (Mining Review Africa, 2008; Midlands Minerals Corp., 2009, p. 2-3, 7-8).

Red Back Mining Inc. of Canada held a 100% interest in the Chirano gold mine, which is located about 100 km from Kumasi in southwestern Ghana. Drilling at the Akwaaba Deeps deposit in 2007 established a high-grade underground resource, which the company began to develop as an underground operation in 2008. To support the new Akwaaba Deeps development, the company planned to commission a new crushing circuit in the first quarter of 2009 and to expand the capacity at its processing plant to 3.5 Mt/yr by the third quarter of 2009. The Chirano gold mine produced 3,757 kg in 2008; production was expected to increase to about 5,300 kg in 2009 and to reach about 7,800 kg in 2010 when the upgrade of the processing plant is finalized and as a result of the addition of high-grade underground ore from the Akwaaba Deeps Mine (Red Back Mining Inc., 2009, p. 3-5, 14-15).

Other companies that conducted gold exploration in Ghana included Moydow Mines International Inc., Volta Resources Inc., and Xtra-Gold Resources Corp. of Canada, and Perseus Mining Ltd. of Australia.

Industrial Minerals

Cement.—Ghana imported clinker, gypsum, and limestone for the manufacturing of cement. Only two companies produced cement in the country—Diamond Cement Ghana Ltd. and Ghana Cement Co. Ltd. ((GHACEM). GHACEM operated

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the country's two clinker-grinding plants at the port cities of Takoradi and Tema. The capacity of each plant was 1.2 Mt/yr. The Government announced that Barclays Gerdi Group Inc. planned to build a 500,000-t/d cement plant in Ghana at a cost of $350 million.

Diamond.—Diamond was recovered by artisanal miners from alluvial deposits near Akwatia in the Birim Valley. The only formal commercial diamond production in the country came from a placer mine in Akwatia, which was operated by Government-owned Ghana Consolidated Diamonds Ltd. (GCD). GCD was idled in September 2007 and remained closed throughout 2008 reportedly owing to lack of capital, an obsolete plant, and inadequate machinery to sustain production. The Government was seeking a suitable investor to take over ownership of the company (Modern Ghana News, 2008a, c, e; Ministry of Lands, Forestry and Mines, 2009a).

In 2006, a report released by the United Nations Group of Experts on Côte d'Ivoire indicated that Ghana was being used as a conduit for the export of conflict diamond originating from rebel-controlled areas in Côte d'Ivoire. According to the report, although Ghana's diamond output was in decline, exports by volume and by value had almost doubled since 2000. The United Nations had recommended that Ghana look into implementing internal control systems that would allow for the tracking of diamonds from mine site to the point of export. At the 2006 Kimberley Process Plenary in Botswana, Ghana agreed to tighten internal controls in the diamond sector, and as a result, Ghana's Minerals Commission began the process of registering artisanal diamond miners in the Lower Birim area in 2008. The country was also in the process of establishing a database for rough diamond (Partnership Africa Canada, 2006a, b; United Nations Security Council, 2006; Modern Ghana News, 2008b).

Ghana's first diamond cutting and polishing school, The Natural Diamond Training Institute, opened in Accra in 2008. The institute was to run a 2-month intensive course, which included rough diamond identification, sorting, cutting, polishing, and marketing (Modern Ghana News, 2008d; Rapaport Diamond Report, 2008).

Mineral Fuels

Natural Gas.—The Government planned to build a new natural gas plant at Atuabo. The plant, which was to be built in multiple stages, was to include a 4-million-cubic-meter (reported as 150-million-cubic-feet) natural gas processing plant. The cost of the project was estimated to be $775 million, and the gas was to be processed into dry gas for electricity generation at the Effasu powerplant and into liquefied petroleum gas for domestic consumption (United Press International Inc., 2008).

In November 2008, the West African Gas Pipeline Company Ltd. (WAPCo) resumed the commissioning of the WAGP facilities at the Itoki natural gas export terminal in Nigeria. In December, natural gas was introduced into the offshore pipeline from Lagos Beach to Takoradi in Ghana. WAPCo had commissioned the Itoki terminal in April 2008 but the commissioning was suspended owing to the appearance of moisture content in the gas, which did not meet the required WAGP specification. The Itoki terminal is the segment of the WAGP that meets the Nigerian Gas Co.'s Escravos-to-Lagos system from which supply is taken. The WAGP, which runs offshore for about 620 km from Badagry in Lagos, Nigeria, to Aboadzi in Sekondi, Ghana, was owned and operated by WAPCo. WAPCo was a joint venture between public and private sector companies from Benin, Ghana, Nigeria, and Togo and included Chevron West African Gas Pipeline Ltd. (36.7%), Nigerian National Petroleum Corp. (25%), Shell Overseas Holdings Ltd. (18%), Takoradi Power Company Ltd. (16.3%), Société Togolaise de Gaz (2%), and Société BenGaz S.A. (2%) (West African Gas Pipeline Company Ltd., 2008, 2009).

Petroleum.—The Jubilee oilfield, which lies about 65 km off the coast of Ghana, was discovered in June 2007 and its appraisal was still underway in 2008. Drilled and undrilled structures into which Jubilee extends are estimated to have the potential to hold more than 3 billion barrels (Gbbl) of petroleum. Texas-based Kosmos Energy LLC and Tullow Oil plc of the United Kingdom held the majority interest in the Jubilee oilfield. The first offshore petroleum discovery, Mahogany-1, was made by Kosmos in June 2007. Tullow, which was awarded the adjoining Deepwater Tano license in 2006, made a second discovery, the Hyedua-1, 2 months after the Kosmos find. Hyedua-1 showed a pressure-connection with Mahogany-1, which indicates a structure extending to about 5.3 km between the two wells. In May 2008, Kosmos drilled Mahogany-2 and proved a structure of at least 11 km in width, with crude of 37 degrees API and combined hydrocarbon columns of more than 600 meters. Although both Kosmos and Tullow claimed the discovery, Tullow emerged as the unit operator with overall responsibility for the field and Kosmos emerged as the technical operator of the integrated project team. The Jubilee oilfield was estimated to hold recoverable reserves of about 500 million barrels of petroleum with the potential of 1.8 Gbbl. The oilfield was to be developed in phases at a total cost of $3.1 billion. In February, Kosmos made another petroleum discovery at the Odum-1 exploration well offshore in the West Cape Three Points Block. Odum-1 is located about 13 km east of the Mahogany-1 well but is part of a different geologic structure (Kosmos Energy LLC, 2008a-c; Petroleum Economist, 2008).

The Government planned to expand the production capacity at the Tema Oil Refinery to 145,000 barrels per day (bbl/d) of petroleum from its current 45,000 bbl/d as the country moved into commercial petroleum production in the near future. The Tema refinery was 100% owned by the Government. The expansion of the refinery was expected to cost between $150 million and $200 million and would be financed by syndicated international loans and by local banks. In June, Ghana's National Petroleum Authority announced that Barclays Gerdi Group had expressed interest in establishing a $1.7 billion oil refinery in Takoradi with a capacity to process 100,000 bbl/d (National Petroleum Authority, 2008; Reuters, 2008).

Outlook

Owing to the recent discovery of petroleum offshore Ghana, the Government is likely to shift its priorities from

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the nonfuel minerals sector to the fuels sector. Petroleum is likely to displace gold as the country's leading mineral export earner in the next 3 to 5 years if plans to develop the Jubilee oilfield come to fruition. The country's favorable political climate, a legislative framework that adequately defines the rights and obligations of investors, and the fact that Ghana was being considered as a candidate country to join the Extractive Industries Transparency Initiative, suggest that the Government is interested in providing a transparent investment climate to attract foreign direct investments in the mineral sector. Mineral prospecting is likely to increase owing to ongoing efforts aimed at completing airborne geophysical surveys and detailed geologic field mapping of the country. Electricity shortages are likely to continue in the short run, although the construction of a new petroleum refinery is expected to aid the sector by providing excess electricity generated by the refinery to the national grid.

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TABLE 1

GHANA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007[e]	2008[e]
Aluminum, primary		--	-- [r]	-- [r]	--	--
Bauxite, gross weight		498	727	886	748 [r, 3]	738 [3]
Cement, hydraulic[e, 4]		1,800 [r]	1,800 [r]	1,800 [r]	1,800 [r]	1,800
Diamond[5]	thousand carats	920	1,013	973	895 [3]	643 [3]
Gold, mine output, Au content	kilograms	63,139	66,852	69,817	83,558 [r, 3]	80,503 [3]
Manganese:						
Ore, processed		1,597	1,715	1,659	1,173 [r, 3]	1,090 [3]
Mn content[e]		559 [3]	600	580	410	380
Natural gas[6, 7]	million cubic meters	9 [e]	--	--	--	--
Petroleum:						
Crude[6]	thousand 42-gallon barrels	400 [e]	--	--	--	--
Refinery products[e]	do.	16,000	16,000	16,000	16,000	16,000
Salt		265	250	123 [r]	124 [r]	150 [e]
Silver, Ag content of exported dore	kilograms	3,329	3,571	3,142	3,300 [r]	3,200
Steel, secondary, rebar[e]		25	25	25	-- [r]	-- [3]

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through October 8, 2009.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) are produced, as are limestone and lime for the processing of some gold ore and salt. Output of these commodities is not reported, however, and information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]All from imported clinker.

[5]Kimberley Process Certification Scheme.

[6]Ghana did not produce natural gas nor petroleum in commercially sustainable quantities.

[7]Reported by Ghana Energy Commission.

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TABLE 2
GHANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	thousand metric tons	Volta Aluminum Co. Ltd. (VALCO) (Government, 100%)	Aluminum smelter at Tema (on care and maintenance)	200.
Bauxite	do.	Ghana Bauxite Co. Ltd. (Rio Tinto Alcan, 80%, and Government, 20%)	Bauxite mine at Awaso	600.
Cement	do.	Ghana Cement Co. Ltd. (GHACEM) (HeidelbergCement AG, 94.5%)	Clinker grinding plant at Takoradi	1,200.
Do.	do.	do.	Clinker grinding plant at Tema	1,200.
Do.	do.	Diamond Cement Ghana Ltd.	Cement plant at Aflao; uses imported clinker	600.
Diamond	thousand carats	Ghana Consolidated Diamonds Ltd. (GCD) (Government, 100%)	Placer mine at Akwatia, Birim Valley	360.
Do.	do.	Artisanal diamond miners	Birim Valley	500 to 900.
Gold	kilograms	AngloGold Ashanti Ltd., 100%	Obuasi surface and underground mine, 80 kilometers from Kumasi	17,000.
Do.	do.	do.	Iduapriem Mine, 70 kilometers north of Takoradi	8,800.
Do.	do.	Central African Gold plc, 100%	Bibiani Mine, 250 kilometers northwest of Accra	3,400.
Do.	thousand metric tons	Golden Star Resources Ltd., 90%, and Government, 10%	Bogoso carbon-in-leach processing plant, 300 kilometers west of Accra	1,500 ore.
Do.	do.	do.	Bogoso sulfide ore processing plant 300 kilometers west of Accra	3,500 ore.
Do.	kilograms	do.	Bogoso/Prestea open pit mine, 300 kilometers west of Accra	5,300.
Do.	thousand metric tons	do.	Wassa carbon-in-leach processing plant, 250 kilometers west of Accra	3,000 ore.
Do.	kilograms	do.	Wassa Mine, 30 kilometers northwest of Tarkwa	5,200.
Do.	do.	do.	Butre Mine, 50 kilometers south of Wassa Mine	NA.
Do.	do.	Golden Star Resources Ltd., 81%	Prestea underground mine (on care and maintenance)	1,100.
Do.	do.	Gold Fields Ltd., 71.1%; IAMGOLD Corp., 18.9%; Government, 10%	Tarkwa open pit mine and carbon-in-leach and heap-leach plants, 300 kilometers west of Accra	21,800
Do.	do.	do.	Damang Mine and carbon-in-leach plant, 360 kilometers west of Accra	6,000
Do.	do.	Newmont Mining Corp., 100%	Ahafo Mine, 290 kilometers northwest of Accra, Brong Ahafo region	17,100.
Do.	thousand metric tons	Chirano Gold Mine Ltd. (Red Back Mining Inc., 100%)	Chirano Mine, 100 kilometers from Kumasi, southwest Ghana	2,100 ore.
Do.	kilograms	do.	do.	3,800.
Do.	do.	Artisanal gold miners	Throughout Ghana	4,000 to 8,000.
Limestone and lime	metric tons	Carmeuse Lime Products (Ghana) Ltd. (Carmeuse SA of Belgium)	Takoradi	NA.
Manganese ore	thousand metric tons	Ghana Manganese Company Ltd. (Ghana International Manganese Co., 90%, and Government 10%).	Open pit mine at Nsuta-Wassaw Western region	1,500.
Petroleum products	thousand barrels	Tema Oil Refinery (Government, 100%)	Refinery at Tema	16,425.
Salt	metric tons	Panbros Salt Industry Ltd.	Salt pan at Mendskrom, near Accra	250,000.
Do.	do.	Elmina Salt Producers Association	Artisanal salt pan mining near Elmina	NA.

Do. Do. Ditto. NA Not available.

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THE MINERAL INDUSTRY OF GUINEA

By Omayra Bermúdez-Lugo

Guinea was among the world's leading producers of bauxite. Other mineral commodities produced in the country included cement, diamond, gold, and salt. Undeveloped mineral resources included graphite, iron ore, limestone, manganese, nickel, and uranium. The Ministère des Mines, de la Géologie et de l'Environnement was the Government agency responsible for the administration of the mining sector.

Production

In 2008, bauxite production increased by about 7% to 19.8 million metric tons (Mt) from 18.5 Mt in 2007; diamond production increased by 204% to 3.1 million carats from about 1.02 million carats, and gold production increased by 27.6% to 19,945 kilograms (kg) from a revised 15,628 kg. Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities. More-extensive coverage of the mineral industry of Guinea can be found in the 2006 and 2007 U.S. Geological Survey Minerals Yearbook, volume III, Area reports—International—Africa and the Middle East, which is available on the Internet at http://minerals.usgs.gov/minerals/pubs/country.

TABLE 1
GUINEA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
Alumina:						
Production:						
Hydrate		10 e	--	--	--	--
Calcined		877 e	722	545	542	527
Shipments, calcined		887 e	722	529	542	527
Bauxite:						
Mine production:						
Wet basis		17,200	16,817 [3,4]	18,784 [3,4]	18,519 [3,4]	19,780 [3,4]
Dry basis		15,254 [4]	14,600 [5]	16,300 [5]	16,100 [5]	17,200 [5]
Shipments (dry basis), metallurgical		14,100	14,100	NA	NA	13,700
Cement		360	360	360	360	360
Diamond[6,7]	thousand carats	674	549	474	1,019	3,098
Gold, mine output, Au content	kilograms	11,100 e	25,097	16,922 [7]	15,628 r,7	19,945 [8]
Salt		15	15	15	15	15

eEstimated data are rounded to no more than three significant digits. rRevised. NA not available. -- Zero.

[1]Table includes data available through October 8, 2009.

[2]In addition to the commodities listed, Guinea produced modest quantities of crude construction materials (clays, sand and gravel, and stone), but information is inadequate to make reliable estimates of output.

[3]Metallurgical ore plus calcinable ore estimated to be 13% water.

[4]Reported figure.

[5]Data are for wet-basis ore estimated to be 13% water reduced to dry basis estimated to be 3% water.

[6]Production is approximately 70% to 80% gem quality.

[7]Figures include artisanal production.

[8]Does not include artisanal mining production, which has historically ranged between 1,500 and 5,000 kilograms per year.

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TABLE 2
GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina		Alumina Company of Guinea (United Company RUSAL, 100%)	Friguia plant, Fria	640,000
Bauxite		Compagnie des Bauxites de Guinée (CBG) [Government, 49%, and Halco Mining Inc., 51% (Halco Mining was a consortium formed by Alcoa Inc., 45%; Alcan Inc., 45%; and Dadco Group, 10%)]	Kamsar and Sangaredi	14,000,000
Do.		Compagnie des Bauxites de Kindia (CBK) (United Company RUSAL, 100%)	Debele Mine, Kindia	3,000,000
Do.		Alumina Company of Guinea (United Company RUSAL, 100%)	Friguia Mine, Fria	2,800,000
Cement		Ciments de Guinée (Holcim Ltd., 51%, and Government, 44%)	Conakry plant	360,000
Diamond	carats	Aredor-First City Mining Co. (Government, 15%, and Azure Resources Corp., 85%)	Aredor Mine	38,000
Do.	do.	Artisanal miners	Mainly in Banankoro	NA
Gold	kilograms	Société Ashanti de Guinée (AngloGold Ashanti Ltd., 85%, and Government, 15%)	Siguiri Mine	10,300
Do.	do.	Société Minière de Dinguiraye (Crew Gold Corp., 85%, and Government, 15%)	Lero-Karta Mine, 700 kilometers northeast of Conakry	3,500
Do.	do.	Société d'Exploitation Minière d'Afrique de l'Ouest Guinée (Semafo Inc., 85%, and Government, 15%)	Kiniero Mine, 650 kilometers east of Conakry	1,700

Do., do. Ditto. NA Not available.

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The Mineral Industries of the Indian Ocean Islands

Comoros, Mauritius, Reunion, and Seychelles

By Harold R. Newman

COMOROS

The Comoro Islands form an archipelago of four islands—Anjouan, Grande Comore, Mayotte, and Moheli. The archipelago is the result of volcanic action along a fissure in the seabed running west-northwest to east-southeast. Grande Comore is the largest and youngest of the islands. Comoros, which is one of the world's poorest countries, has few transportation links between its islands, a young and rapidly increasing population, and few natural resources. Economic growth from 2006 to 2008 averaged only about 1% (U.S. Central Intelligence Agency, 2009).

Comoros did not play a significant role in the world's production or consumption of mineral resources. The mineral industry of Comoros continued to be limited to producing only common local building materials, such as clay, crushed stone, gravel, and sand during 2008.

The demand for cement, steel, petroleum, and petroleum products was met through imports. In 2007 (the latest year for which data were available), Comoros imported 41,508 metric tons (t) of cement, 35,837 t of petroleum products, and 3,167 t steel (International Monetary Fund, 2009, p. 57).

Mineral production data were not available; however, mineral production was presumed to be low because no significant construction projects were reported in 2008. The outlook is for little change in the foreseeable future.

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MAURITIUS

The islands of Mauritius consist of the main island of Mauritius, the smaller island of Rodrigues, and two smaller groups of islands. All islands are of volcanic origin and are surrounded by coral reefs.

The mineral industry of Mauritius was a negligible factor in the economy. The country has few mineral resources. Historically, mineral output consisted of basalt construction stone, coral sand, lime from coral, and solar-evaporated salt. The demand for cement, fertilizers, iron and steel, flat-rolled metal products, and petroleum products was met through imports. In 2008, imports included mineral fuels and related products (21.4%), machinery and equipment (19.6%), manufactured goods (18.9%), and other unidentified products (40.1%). The Mauritius Free Port handled 72,617 t of imports and 85,195 t of reexports (United Nations Statistics Division, 2009).

Polymetallic nodules occur on the ocean floor at a depth of about 4,000 meters (m) and extend from 400 kilometers (km) to 800 km north of Port Louis, which is located northeast of Tromelin Island. The nodules each average more than 15% iron and manganese and more than 0.3% cobalt. The abundance of global land-based resources made it unlikely that these offshore resources would be developed in the foreseeable future (Nations Encyclopedia, 2008).

Mauritius did not play a significant role in the world's production or consumption of minerals. Data on mineral production are in table 1. The outlook for exploration of minerals other than for construction materials was negligible.

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REUNION

Reunion is a volcanic island located in the Indian Ocean about 200 km southwest of Mauritius. Administratively, it is one of the overseas departments of France and, as such, is part of the Eurozone.

Mineral commodity production represented only a small part of the economy of Reunion in 2008 as in previous years. Although little quantitative information on mineral production was available, aggregates, cement, and seacoast coral continued to meet local consumption needs. Mineral fuels and petroleum products were imported. The most significant producer of mineral products was Holcim (Reunion) S.A., which was a privately owned cement company.

SEYCHELLES

The Seychelles archipelago, which comprises 74 coralline islands and the Mahe group of 41 granitic islands, lies in the western part of the Indian Ocean and was part of a former microcontinent. The coralline group was, for the most part, only a little above sea level.

Seychelles has very limited mineral resources. Mining was limited mainly to granite quarrying and salt pans. Mineral

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production consisted mostly of the production of such construction materials as clay, coral, sand, and stone. There was occasional mining of guano, an organic phosphate fertilizer composed of bird droppings, that was not reported by the Government. Seychelles has no indigenous sources of coal, natural gas, or petroleum. As there is no petroleum refinery, petroleum refinery products must be imported to meet the country's requirements (Institute for Security Studies, The, 2008).

The Government is likely to continue to promote the petroleum potential of Seychelles.

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TABLE 1
MAURITIUS, REUNION, AND SEYCHELLES: PRODUCTION OF MINERAL COMMODITIES [1]

(Metric tons unless otherwise specified)

Country and commodity	2004	2005	2006	2007[e]	2008[e]
MAURITIUS[2]					
Cement[3]	650,000	694,000	717,000	616,000	811,000 [4]
Fertilizers[3]	89,400	85,000	86,000	86,000	86,000
Salt, marine	7,000	7,900	7,408 [r]	6,650 [r, 4]	6,800
Sand	60,000	60,135	91,422	91,232 [4]	102,972 [4]
Steel, rebar[3]	59,000	60,500	62,000	70,000	70,000
REUNION[e, 5]					
Aggregates	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Cement	380,000	380,000	400,000	400,000	400,000
SEYCHELLES[e]					
Aggregates	120,000	120,000	117,794 [r, 4]	128,014 [r, 4]	130,000
Dimension stone, granite	135 [r]	140 [r]	141 [r, 4]	149 [r, 4]	150
Gravel and crushed stone	210,000	210,000	142,584 [r, 4]	135,888 [r, 4]	140,000
Sand	8,100	8,100	8,100	8,100	8,100

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised.
[1]Table includes data available through July 31, 2009.
[2]In addition to the commodities listed, asphalt, basalt, and lime are also known to be produced, but information is inadequate to make reliable estimates of output.
[3]Imports
[4]Reported figure.
[5]In addition to the commodities listed, coral and volcanic rock are also known to be produced, but information is inadequate to make reliable estimates of output.

TABLE 2
MAURITIUS, REUNION, AND SEYCHELLES: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
MAURITIUS			
Aggregates	United Basalt Products Ltd.	La Mecque	660,000 [e]
Do.	Gamma Civic Ltd.	Beau Bassin and Solitude	NA
Fertilizers	Mauritius Chemical and Fertilizer Industry Ltd.	Port Louis	100,000
Salt	Mont Calme Ltd.	Tamarin	NA
Steel	Samlo Koyenco Steel Co. Ltd.	Port Louis	65,000
REUNION			
Aggregates	Holcim (Reunion) S.A.	Bras Panon and Saint-Joseph	1,300,000 [e]
Cement	do.	Le Port	400,000
SEYCHELLES			
Granite	Gondwana Granite Ltd.	Victoria	NA
Gravel and crushed stone	United Concrete Products (Seychelles) Ltd.	Anse des Genets	150,000 [e]
Do.	Civil Construction Company Ltd.	Brilliant	97,000 [e]

[e]Estimated. Do., do. Ditto. NA Not available.

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The Mineral Industry of Kenya

By Thomas R. Yager

In 2008, Kenya played a significant role in the world's production of fluorspar and natural soda ash. The country's share of the world's mine production of soda ash amounted to 3%, and that of fluorspar, to nearly 2%. Other domestically significant mineral processing operations included cement and petroleum refining. Kenya was not a globally significant consumer of minerals (Kostick, 2009; Miller, 2009).

Minerals in the National Economy

In 2008, the manufacturing sector accounted for 10% of the gross domestic product, and mining and quarrying, 0.5%. The mining and quarrying sector grew by 3.2% in 2008 compared with 12.9% in 2007 and 4.1% in 2006. Formal employment in the mining and quarrying sector was reported to be 6,300 in 2007 (the latest year for which data were available); total mining and quarrying employment was estimated to be more than 50,000 (Poggiolini, 2007; Central Bank of Kenya, 2009b, p. 14).

Production

In 2008, the production of salt by Magadi Soda Ash Ltd. increased by 110%; natural carbon dioxide gas, by 100%; soda ash, by 33%; cement, by 23%; and fluorspar, by 19%. From 2003 to 2008, soda ash production increased by 46%. In 2008, Kenya's gold production decreased by 89%, and diatomite, by 64%. The production of most gemstones was estimated to have decreased by between 20% and 25%.

Structure of the Mineral Industry

Most of Kenya's mining and mineral processing operations were privately owned, including the diatomite, fluorspar, gemstone, salt, and soda ash mines, the lime plants, and the steel mills. Athi River Mining Ltd. (ARM) and Bamburi Cement Ltd. were privately owned. The Government held a 52% share in East Africa Portland Cement Co. Ltd. (EAPC) and a 50% share in Kenya Petroleum Refineries Ltd. (KPRL). Artisanal miners produced gemstones and gold in areas that included Nyanza, Rift Valley, and Western Provinces.

Commodity Review

Metals

Gold.—Artisanal miners accounted for Kenya's gold production. Goldplat plc of South Africa and International Gold Exploration AB (IGE) of Sweden were engaged in a joint venture to produce gold at Kilimapesa. The companies planned to export gold from an underground mine and from the tailings of artisanal mining operations to South Africa starting in April 2009. IGE also conducted stream sampling at Rongo and Sekerr in 2008 (International Gold Exploration AB, 2009, p. 17-18).

Industrial Minerals

Cement.—Kenya had three cement producers with a combined capacity of 3.1 million metric tons per year (Mt/yr). National cement production increased to 3.13 million metric tons (Mt) in 2008 from a revised 2.55 Mt in 2007. The increased output was attributable to recent capacity expansions and increased utilization of existing capacity (Central Bank of Kenya, 2009a, p. 18).

EAPC planned to increase its capacity to about 1.4 Mt/yr from 720,000 metric tons per year (t/yr) in 2009. ARM planned to complete the expansion of its capacity to 600,000 t/yr from 300,000 t/yr in 2010. The estimated cost of ARM's expansion was $15 million. Catic Cement (Kenya) Company Ltd., which was owned by Chinese investors, planned to build a new cement plant in Kitengela with a capacity of 440,000 t/yr. In April 2008, Catic agreed to relocate the proposed plant to a new site adjacent to EAPC's plant because of environmental concerns about dust and other pollutants. The company started negotiations with a local landowner for a long-term lease agreement (Building Bulletin, 2008; National Environmental Management Authority, 2008; Onyango, 2008).

In 2008, Kenya's cement consumption increased to nearly 2.79 Mt compared with about 2.02 Mt in 2007 because of growth in the construction sector. Bamburi held a 59% share of the domestic cement market; EAPC, 30%; and ARM, 11% (Omondi, 2008; Central Bank of Kenya, 2009a, p. 21).

Fluorspar.—In 2008, Kenya Fluorspar Co. (KFC) increased its production to 98,248 metric tons (t) from 82,000 t in 2007. The increase may have been attributable to recent improvements to the plant and equipment that included an upgrade of the crushing system. Most of KFC's production was exported to India (East African, 2008).

Gemstones.—Rockland Kenya Ltd. mined ruby and pink sapphire at the John Saul Mine in southern Kenya. In the first half of 2008, Rockland was producing at the rate of between 200 and 500 kilograms per month. Most of the mine's output, which was cabochon grade, was exported to Thailand for cutting (Laurs, 2008).

Tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium, was produced in southern Kenya. Local mines employed between 10 and 50 miners each; most of the mines were not mechanized. Altogether, about 2,000 Kenyans were reportedly employed in tsavorite mining and trading (Pardieu and Hughes, 2009).

Soda Ash.—Magadi Soda Ash Ltd. mined trona from Lake Magadi. The production of soda ash increased to 513,415 t in 2008 from 386,598 t in 2007. Recent production increases were attributable to a new processing plant that increased capacity to 715,000 t/yr from 350,000 t/yr (table 2). Most of Magadi's output was exported. Soda ash was consumed domestically by ARM in the production of sodium silicate, which was used in detergents, soaps, and chemical and metallurgical applications.

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In 2008, ARM planned to produce sodium silicate at its plant's full capacity of 60,000 t/yr. Soda ash was also consumed by domestic glass producers (Makarudze and Hoffman, 2008; Central Bank of Kenya, 2009a, p. 18).

Stone, Crushed.—Most of Kenya's coral and limestone was produced in Coastal Province; pozzolanic materials were produced in Rift Valley Province. ARM and Bamburi were engaged in a dispute concerning mining rights to the Mutomo limestone deposits in Eastern Province. The local government divided the disputed property between ARM and Bamburi; ARM was awarded a 33-year mining license for its part of the property. Bamburi appealed the decision, and the dispute was unresolved at the end of 2008 (Choto, 2009).

Mineral Fuels

Petroleum.—China National Offshore Oil Company Ltd. and Lundin Petroleum AB of Sweden planned to drill an exploration well on Block 9 in north-central Kenya by the third quarter of 2009. Vangold Resources Ltd. of Canada planned to drill an exploration well at Block 3A by 2010. East African Exploration Ltd. (a subsidiary of Black Marlin Energy Group of the United Arab Emirates) planned to drill exploration wells at Blocks L17 and L18 by 2010 or 2011. Dana Petroleum (E&P) Ltd. of the United Kingdom and Global Petroleum Ltd. terminated their joint venture with Woodside Energy Ltd. of Australia for Blocks L5 and L7 after Woodside decided not to drill a second exploration well (East African Exploration Ltd., 2008; Senelwa, 2008; Vangold Resources Ltd., 2009).

Outlook

Cement production is likely to increase because of the increased capacity at ARM, EAPC, and the new plant to be built by Catic. Cement demand in east Africa is expected to increase to 11 Mt/yr in 2012 from 5.5 Mt/yr in 2008. The production of gypsum, limestone, and pozzolanic materials for use in the cement industry could also increase. The outlook for fluorspar, gemstones, and soda ash depends heavily on world market conditions; the world financial crisis could cause reduced production in 2009 (Building Bulletin, 2008).

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TABLE 1
KENYA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006[e]	2007[e]	2008[e]
Aluminum, secondary[e]		2,400	2,400	2,400	2,400	2,400
Carbon dioxide gas, natural		5,982	8,723	9,359 [3]	11,028 [r, 3]	22,030 [3]
Cement, hydraulic	thousand metric tons	1,789	2,123	2,174 [3]	2,546 [r, 3]	3,135 [3]
Clays:[e]						
Bentonite		50	50	60	70 [r]	70
Kaolin		760	780	810 [r]	910 [r]	940
Other		20,000	20,000	21,000 [r]	24,000 [r]	25,000
Diatomite[4]		330	243	185 [3]	201 [r, 3]	72 [3]
Feldspar		40	22 [3]	25	30 [r]	30
Fluorspar, acid grade		108,000	97,261	83,428 [3]	82,000 [3]	98,248 [3]
Gemstones, precious and semiprecious:[e]						
Amethyst	kilograms	82 [3]	73 [3]	75	80 [r]	60
Aquamarine	do.	331 [3]	250	260	290 [r]	210
Cordierite, iolite	do.	92 [3]	81 [3]	85	100 [r]	80
Green garnet	do.	1,603 [3]	800	830	940 [r]	700
Ruby	do.	4,758 [3]	5,100	5,300	6,000 [r]	4,500
Sapphire	do.	2,000	3,500	3,600	4,100 [r]	3,000
Tourmaline	do.	4,000	8,000	8,300	9,400 [r]	7,000
Gold, mine output, Au content[4]	do.	567	616	432 [3]	3,023 [r, 3]	340 [3]
Gypsum and anhydrite[e]		8,900	9,100	9,500 [r]	11,000 [r]	11,000
Iron ore[e]		500	300 [3]	310 [r]	350 [r]	360
Lead, refined secondary		1,000	1,000	1,000	1,000	1,000
Lime[e]		50,000	50,000	50,000	50,000	50,000
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	2,346	2,294 [r]	1,527 [3]	1,500 [r, 3]	1,500
Kerosene[5]	do.	734 [r]	711	912 [3]	796 [r, 3]	800
Jet fuel[5]	do.	1,681 [r]	1,626	1,792 [3]	1,871 [r, 3]	1,900
Distillate fuel oil	do.	2,890 [r]	2,793 [r]	2,748 [r, 3]	2,962 [r, 3]	3,000
Residual fuel oil	do.	4,295 [r]	3,815 [r]	4,127 [r, 3]	3,556 [r, 3]	3,600
Liquefied petroleum gas	do.	331 [r]	318 [r]	365 [r, 3]	383 [r, 3]	380
Other	do.	758 [r]	959 [r]	935 [r, 3]	930 [r, 3]	920
Total	do.	13,035 [r]	12,516 [r]	12,406 [r, 3]	11,998 [r, 3]	12,100
Salt, crude[6]		31,139 [r]	26,595 [r]	35,024 [r, 3]	11,596 [r, 3]	24,345 [3]
Soda ash		353,835	360,161	374,210 [3]	386,598 [3]	513,415 [3]
Stone, sand and gravel:[e]						
Granite for dimension stone		200	200	210 [r]	240 [r]	240
Limestone for cement	thousand metric tons	870	1,000	1,100 [r]	1,200 [r]	1,500
Limestone for dimension stone		34,000	35,000	36,000 [r]	41,000 [r]	42,000
Marble for dimension stone		130	130	130	150 [r]	150
Sand, industrial; glass		13,000	14,000	14,000	16,000 [r]	16,000
Shale		210,000	210,000	220,000 [r]	250,000 [r]	260,000
Sulfuric acid		20,000 [e]	20,000 [e]	20,000	20,000	20,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto.

[1]Table includes data available through March 11, 2010.

[2]In addition to the commodities listed, a variety of minerals and construction materials [brick clays, coal, gravel, meerschaum, mica, murram (laterite), crushed rock, and construction sand] may be produced, but quantities are not reported, and available information is inadequate to make estimates of output.

[3]Reported figure.

[4]Exports.

[5]Formerly combined as jet fuel and kerosene.

[6]Production by Magadi Soda Ash Ltd. only.

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TABLE 2
KENYA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Carbon dioxide gas, natural		Carbacid Ltd.	Mine at Kereita	22,000 e
Cement		Bamburi Cement Ltd. (Lafarge Group, 58.6%)	Plants at Mombasa and Nairobi	2,100,000
Do.		East African Portland Cement Co. Ltd. (EAPC) (LaFarge Group, 41.7%; National Social Security Fund, 27%; Government, 25%)	Plant at Athi River	720,000
Do.		Athi River Mining Ltd. (ARM)	Plant at Kaloleni	300,000
Diatomite		African Diatomite Industries Ltd.	Kariandusi and Soysambu	4,000
Fluorspar		Kenya Fluorspar Ltd.	Mine at Kerio Valley	120,000
Garnet	kilograms	Bridges Exploration Ltd.	Scorpion Mine in Taita Taveta	40
Glass		Central Glass Industries Ltd.	Plant at Nairobi	47,500
Do.		Bawazir Glass Works Ltd.	Plant at Mombasa	NA
Gold	kilograms	Artisanal miners	Mines in Nyanza, Rift Valley, and Western Provinces	NA
Lead, refined secondary		Associated Battery Manufacturers Co. Ltd.	Plant at Athi River	3,000
Lime		Homa Lime Company Ltd.	Plant at Koru	30,000
Do.		Athi River Mining Ltd. (ARM)	Plant at Kaloleni	25,000
Petroleum, refined	thousand 42-gallon barrels	Kenya Petroleum Refineries Ltd. (KPRL) (Government, 50%; Royal Dutch/Shell Group, 17.1%; BP p.l.c., 17.1%; and Chevron Corp., 15.8%)	Refinery at Mombasa	31,500
Ruby and sapphire	kilograms	Rockland Kenya Ltd.	Mine at Kasigau	6,000 e
Salt		Magadi Soda Ash Ltd. (Brunner Mond Group Ltd., 100%)	Mine at Magadi	45,000
Do.		Krystalline Salt Ltd.	Mine at Nairobi	NA
Do.		Mombasa Salt Works Ltd.	Mine at Mombasa	NA
Soda ash		Magadi Soda Ash Ltd.	Mine at Magadi	715,000
Sodium silicate		Athi River Mining Ltd. (ARM)	Plants at Athi River and Kaloleni	60,000
Steel:[1]				
Crude		Devki Steel Mills Ltd.	Plant at Nairobi	45,000
Do.		Kenya United Steel Co. Ltd. (subsidiary of Alam Group of Companies)	Plant at Mombasa	20,000
Billet		Devki Steel Mills Ltd.	Plant at Nairobi	50,000
Do.		Kenya United Steel Co. Ltd.	Plant at Mombasa	20,000 e
Rolled		Mabati Rolling Mills Ltd.	do.	100,000
Do.		Standard Rolling Mills Ltd.	do.	80,000
Do.		Devki Steel Mills Ltd.	Plant at Nairobi	36,000
Do.		Kenya United Steel Co. Ltd.	Plant at Mombasa	30,000
Sulfuric acid		Kel Chemicals Ltd.	Plant at Thika	32,000
Do.		East African Heavy Chemicals	Plant at Webuye	NA

eEstimated. Do., do. Ditto. NA Not available.
[1]In addition to its billet and rolled-steel facilities, Kenya has three galvanized steel plants with a combined capacity of 175,000 metric tons per year.

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The Mineral Industries of Lesotho and Swaziland

By Harold R. Newman

LESOTHO

With the exception of diamond mining, the mining and quarrying sector did not play a significant role in Lesotho's economy in 2008. Although Lesotho was believed to have significant mineral deposits, attempts at exploitation continued to be limited owing to lack of infrastructure and investment. Identified deposits included base metals, clays, diamond, dimension stone, sand and gravel, and uranium. Reserves of bituminous coal and shale have been identified in several areas of the country. There is a high concentration of kimberlite intrusion in northern Lesotho.

The Mines and Minerals Act of 2005, the Mine Safety Act of 1981, and the Precious Stones Order of 1970 provide for the administration of mineral exploration and development. The Ministry of Natural Resources through the Department of Mines and Geology is responsible for the regulation of the mining sector and coordination of development and operational activities in the energy, mining, and water sectors. The Act allows for investment by foreign and locally registered companies that agree to abide by mine safety regulations and income tax laws and to pay rentals on lease areas and royalties on the production. A 10% royalty is assessed on the value of diamond. Lesotho is a participant in the International Kimberley Process Certification Scheme, which governs international trade in rough diamond (Department of Mines and Geology, 2008).

Production

The country has a long history of diamond production, which is the major economic mineral of Lesotho. Diamond contributed almost 7% of the gross domestic product (GDP) in 2008 and employed about 1,300 people (Lekhetho, 2009). Data on mineral production are in table 1.

Structure of the Mineral Industry

The mineral industry of Lesotho was modest in size and mostly privately owned. The major mineral processing facilities and their capacities are in table 2.

Commodity Review

Industrial Minerals

Diamond.—In 2008, Gem Diamonds Ltd. announced the sale of the Light of Letseng, a 478-carat white diamond recovered at the Letseng Mine, for $18.4 million to South Africa Diamond Corp. (SAFDICO), which was the manufacturing arm of Graff Jewelers Ltd. of the United Kingdom and one of the world's leading diamond manufacturing and trading companies. The price translated to about $38,500 per carat. SAFDICO also bought the Lesotho Promise in 2006 and the Letseng Legacy in 2007 from Gem Diamonds. The Light of Letseng ranked as the 20th largest rough diamond to be recovered anywhere in the world. The Letseng Mine has produced four of the world's 20 largest rough diamonds and the 3 largest diamonds that have been recovered in this century. Letseng produced 60% of the world's large white high-quality rough diamond. Excluding the Light of Letseng, Gem Diamonds sold 84,474 carats of diamond in 2008 (van der Merwe, 2008).

Gem Diamonds announced that it was moving downstream in the diamond business through the establishment of its own cutting and polishing operation. To this end, Gem Diamonds recruited Matrix Diamond Technology of Belgium, which had developed the world's most advanced and sophisticated diamond mapping technology. When applied to large complex rough diamonds, such as those recovered at the Letseng Mine, this technology has the ability to enhance the polished yield. Gem Diamonds announced that it had doubled the capacity of the Letseng Mine from 2.6 million metric tons per year (Mt/yr) of ore in 2007 to 5.3 Mt/yr in 2008 through a second gravity-fed plant. The mine has the capacity to process about 7 Mt/yr of ore, which would produce about 100,000 carats. The production decreased in 2007 owing to global economic conditions (MBendi Information Services (Pty) Ltd., 2008).

Global Diamond Resources plc (formerly Lesotho Diamond Corp.) of Gibraltar announced that it had commissioned its Kao Mine in late 2007. In 2008, the mine entered the first production phase, including bulk sampling. After 30,000 carats had been produced as required by the bank feasibility study, a decision would be made whether to enter into the second phase of production. Global Diamond stated that the mine was one of the largest unexploited diamond resources in the world and was expected to produce about 740,000 carats per year during its anticipated 30-year mine life (Strategic Investments Ltd., 2008).

Kopane Diamond Developments announced that the Liqhobong Satellite plant project would be placed on care-and-maintenance status at yearend owing to the economic and market turbulence. The company said that it would focus on advancing the appraisal and development of the Liqhobong Main Pipe project to take full advantage of a recovery in diamond prices in the future (Pringle, 2008).

The joint venture of Lucara Diamond Corp. and Mothae Diamond Inc. of Canada announced results of an audit of diamond recovery tailings from the phase 1 bulk sampling program at the Mothae project. Reprocessing of the tailings resulted in recovery of an additional 621 carats in 1,851 stones. The total recovery from the phase 1 program was 1,204 carats. Based on a revised survey, total kimberlite tonnage processed was 24,655 metric tons (t), which resulted in a grade estimate of 4.89 carats per hundred metric tons. A total

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of 58 stones of greater than 2 carats and 13 stones of greater than 5 carats were recovered; the three largest diamonds were 10.24 carats, 8.65 carats, and 8.51 carats, respectively. Phase 2 of the sampling program was begun in 2008, in which up to an additional 70,000 t of kimberlite was to be processed. Mining and stockpiling of kimberlite was in progress in 2008. The Mothae kimberlite project is located 6.5 kilometers from the Letseng Mine, which produced the world's highest value run-of-mine diamond (Lucara Diamond Corp., 2008).

Outlook

Diamond production is not likely to increase significantly until there is a recovery from the global economic crisis. The outlook for the remainder of Lesotho's mineral industry was for little change in the near future. Limited investment in the mineral sector and high rates of HIV/AIDS infection, coupled with constraints in education, will influence development into the foreseeable future.

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SWAZILAND

Mining has declined in importance in Swaziland in recent years and, in 2008, the mineral industry was not a significant contributor to the country's GDP. The Government announced that the Swaziland Electricity Co. was planning to develop a 120-megawatt hydroelectric plant and had invited submissions from engineering firms for feasibility and predesign studies (Engineering News, 2009).

Production

Information on the mineral industry of Swaziland was not readily available. Production of anthracite coal and quarried stone was estimated to be about the same as in 2007. The quarrying of stone was for domestic consumption and depended on local demand. Xstrata plc of Switzerland operated a ferrovanadium plant at Maloma with a capacity of 2,400 metric tons per year. Production of ferrovanadium in 2008 was estimated to be about the same as in 2007. Data on mineral production are in table 1.

Structure of the Mineral Industry

The principal mining and mineral processing facilities in Swaziland, with their locations and capacities, are listed in table 2.

Outlook

The outlook for Swaziland's mineral industry is for little change in the near future. The low level of exploration is expected to continue to constrain increases in production.

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TABLE 1
LESOTHO AND SWAZILAND: PRODUCTION OF MINERAL COMMODITIES[1]

Country and commodity		2004	2005	2006	2007	2008[e]
LESOTHO[2]						
Fire clay[e]	cubic meters	15,000	15,000	15,000	15,000	15,000
Diamond	carats	26,607 [r]	52,036 [r]	231,324 [r]	454,014	450,000
Stone, quarry products:[e]						
Dimension stone	square meters	1,000	1,000	1,000	1,000	1,000
Gravel and crushed rock	cubic meters	300,000	300,000	300,000	300,000	300,000
SWAZILAND[3]						
Coal, anthracite	metric tons	488,314	222,000	310,570 [r]	241,283	250,000
Ferrovanadium	do.	1,150	345	491	500 [e]	500
Stone, quarry products	cubic meters	230,062	567,000	534,688	207,535	300,000

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto.

[1]Table includes data available through June 30, 2009.

[2]Reported data from Lesotho Department of Mines and Geology.

[3]In addition to the commodities listed, modest quantities of crude construction materials (brick clay and sand and gravel), kaolin, pyrophyllite (talc), and soapstone are produced, but output is not reported quantitatively, and information is inadequate to make reliable estimates of output.

TABLE 2
LESOTHO AND SWAZILAND: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
LESOTHO				
Diamond	carats	Gem Diamond Mining Co. Ltd., 76%, and Government 24%	Letseng Mine	100,000
SWAZILAND				
Coal		Maloma Colliery Ltd.	Maloma Mine at Maloma	500,000
Ferrovanadium		Swazi Vanadium (Pty) Ltd.	Maloma	2,400

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The Mineral Industry of Liberia

By Omayra Bermúdez-Lugo

Liberia continued to recover from a 14-year-long civil war that ended in 2003 and that had brought the country's political system and economic sector to a standstill. In 2008, the country made significant progress in the rehabilitation of the mining sector, which before 1990 had contributed more than 65% of export earnings and represented about 25% of the country's gross domestic product. During the civil war, all major mines were closed and these contributions were reduced to negligible levels. Proceeds from small-scale mining, mainly diamond, were used to a large extent to finance the war. In 2008, the only mineral commodities being produced in the country were cement, crushed stone, diamond, gold, and sand; the mineral sector generated about $6.43 million in revenues for the Government and employed an estimated 2,508 people (Ministry of Lands, Mines and Energy, 2008b; 2009; Central Bank of Liberia, 2009, p. 35).

Liberia resumed exporting rough diamond in September 2007, and in November of the same year, the country participated in the Kimberley Process Certification Scheme plenary meeting in Brussels. In an effort to reorganize the diamond sector, the Government converted the Diamonds Office into the Office of Precious Minerals, and the Presidential Task Force on Diamonds into the Liberian Diamond Board. The Government also completed the draft of a new mineral policy and was working on the establishment of a mining cadastre (United Nations Security Council, 2008a; 2008b, p. 9, 16).

The United Nations Security Council (UNSC) estimated that in the absence of a proper mining cadastre, there was an increasing possibility of conflict between local artisanal miners and mining concession holders. This was especially true given that the activities related to artisanal gold mining were numerous and located in remote and inaccessible areas that made it easy for young males, who were often ex-combatants, to maintain their former command structures, especially in the absence of other employment alternatives. The UNSC estimated that the majority of gold mined in Liberia was unregulated and not subject to payment of royalties to the Government (United Nations Security Council, 2008a; 2008b, p. 5).

Government Policies and Programs

The Ministry of Lands, Mines, and Energy was the Government agency responsible for the administration of the mining sector and had statutory oversight for the energy, land, mineral, and water sectors. The new draft Mineral Policy was undergoing a validation process and was to be presented to the Cabinet for endorsement by April 2009. A total of 33 mineral exploration licenses were issued in 2008 (Ministry of Lands, Mines and Energy, 2009).

A tender process for the mining of the Western Cluster Iron Ore (WIOC) project was initiated in 2008. A procedural error in the evaluation of bids forced the tender to be reissued during the year, and the selection process was expected to be completed in 2009. A tender for the Bong Range iron ore project in central Liberia was issued, and China Union Investment Ltd. was the company selected to develop the project (Central Bank of Liberia, 2009, p. 32-33).

Production

Cement production decreased by 40% to 94,037 metric tons (t) in 2008 from 157,200 t in 2007. The decrease in cement production was a result of insufficient production capacity from the country's sole cement plant. Diamond production, which was resumed in April 2007 after the UNSC lifted the more than 3-year-old ban on diamond imports from the country, increased by 179% to 60,536 carats. The significant increase in diamond production was attributable to a shift in human and capital resources from gold production to diamond production owing to the higher financial returns obtained from the mining of diamond compared with that of gold. Production of gold was not affected by the shift, increasing by 100% to 624 kilograms (kg) compared with 311 kg produced in 2007. The increase in gold production, although seemingly contradictory, was the result of an increase in the number of artisanal miners operating in the country and of an increase in the number of industrial gold mining operations (Central Bank of Liberia, 2009, p. 31-33). Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Mineral Trade

Liberia's exports to the United States were valued at about $143 million in 2008 compared with about $115 million in 2007 and $140 million in 2006; $1.6 million of these exports was from rough diamond. Imports from the United States were valued at about $157 million in 2008 compared with $76 million in 2007 and $68 million in 2006. These included nearly $17 million for railway transportation equipment; $3.2 million for excavating machinery; $131,000 in specialized mining equipment, and $97,000 for drilling and oilfield equipment. Liberia's total proceeds from diamond sales increased fourfold to $9.8 million in 2008 from $2.7 million in 2007; receipts from gold more than doubled to $12.1 million for the same period (U.S. Census Bureau, 2008a, b; Central Bank of Liberia, 2009, p. 39).

Commodity Review

Metals

Gold.—During the second quarter of 2008, Mano River Resources Inc. (MRR) of Canada completed a drilling program

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for the New Liberty Gold Mine (NLG) deposit, which is located about 90 kilometers (km) north of the capital city of Monrovia. The results obtained from the drilling program indicated the potential to expand the resources that had been estimated by a feasibility study conducted in early 2007, which envisioned an open pit operation. The 2007 feasibility study, which was conducted by MDM Engineering Pty Ltd. of South Africa and Lower Quartile Solutions of Australia, estimated total measured and indicated mineral resources at NLG to be about 13.5 million metric tons (Mt) of ore at an average grade of 3.18 grams per metric ton gold. In September 2008, AMC Consultants Ltd. of the United Kingdom undertook a conceptual mining study on the potential of developing an underground operation at NLG. The consultants concluded that infill drilling work of up to 300 meters (m) depth was needed to reevaluate the underground resource. MRR planned to conduct additional drilling in 2009 and to complete a revised feasibility study for an underground mine by 2010. MRR also held ownership in the Weaju gold concession, which is located 30 km to the northeast of the NLG concession. Soil geochemistry and geologic mapping had been conducted at Weaju, and the company planned to conduct a resource definition drilling program in the second half of 2009 (African Aura Mining Inc., 2008b; Mano River Resources Inc., 2009, p. 4-5).

Diamond Fields International Ltd. (DFI) of Canada held exploration licenses for several properties in western Liberia that were prospective for diamond and gold; these included the Gbapolu (Gran Cape) property and the Grand Gedeh property. Gbapolu is subdivided into the Grand Cape and Henry Town Blocks. In 2008, the company collected 7,000 soil samples from Henry Town based on a 5-m by 25-m grid infilling program and identified two types of mineralization at the Barteajam target within Gran Gedeh. DFI planned to commission a drilling rig to begin an extensive evaluation of the Barteajam and the Henry Town gold prospects in 2009 (Diamond Fields International Ltd., 2008, p. 3-6).

Iron Ore.—ArcelorMittal, which was granted a mining development contract for the western iron ore deposits in Nimba County in April 2007, began the process of rehabilitating the 267-km rail track that connects the old Yekepa Mine in Nimba County with the city of Buchanan in Grand Bassa County. The rehabilitation of the rail track was expected to be completed by June 2009. In March, the company hired the services of a Liberian construction company (name not disclosed) to rehabilitate and maintain the 220-km stretch of the road that connects the town of Gorblee in Grand Bassa County to the town of Ganta in Nimba County. The rehabilitation of the road was estimated to cost $2 million. The company also completed the construction of 188 housing units in Buchanan and Yekepa (AllAfrica Global Media, 2008b, d).

On May 7, 2007, the Government had put up for tender the WIOC, which consisted of several iron ore deposits covering about 208 square kilometers near the coast in northwestern Liberia. These deposits included the Bomi Hill and the Mano River iron ore deposits, which were mined from the early 1960s but closed during the late 1980s owing to the beginning of the civil war; and the Bea Mountains iron ore deposits, which remained undeveloped. Seven companies placed bids for the WIOC, including Luxembourg-based ArcelorMittal, Bahlodi Group Holdings of South Africa, Companhia Vale do Rio Doce of Brazil, Sinosteel Zhejiang Co. Ltd. of China, Tata Steel Ltd. of India, and Xingxing Group Co. of China. In early January 2008, Delta Mining Consolidated Ltd. of South Africa was announced as the winner of the tender and was to invest $1.6 billion in the development of the WIOC. Questions concerning the Government's decision to select a junior South African exploration and mining company instead of major players in the industry, such as Tata Steel, which had offered to invest $2 billion in the project, began to surface early in the year, and by September, the Government announced that it was canceling Delta Mining's contract for the WIOC and launching a new bidding round. Delta Mining and Tata Steel were barred from participating in the new bidding round, reportedly owing to violations related to external influence and impropriety during the selection process (no further details were provided). In November, Delta Mining and Tata Steel were cleared to participate in the new tender after Delta filed a complaint against its disqualification, and in December, Delta filed suit against the Government for the loss of its contract, stating that the Government's reasons for disqualifying the company had no basis in law. The new deadline set by the Government for the submission of sealed bids for the second WIOC bidding round was February 23, 2009 (AllAfrica Global Media, 2008e; Bax, 2008; Derby, 2008; Mukumbira, 2008; Toweh, 2008).

The Mano River deposits, which were formerly mined by the National Iron Ore Co., are located about 140 km to the northwest of Monrovia. The Government estimated the iron ore reserves at Mano River to be 80 Mt containing 51.4% Fe. The Bomi Hills deposits, which were formerly mined by the Liberia Mining Co., are located in Bomi County about 70 km northwest of Monrovia. Iron ore reserves were estimated to be about 50 Mt containing 68% iron. The Bea Mountain deposits are located about 100 km to the northwest of Monrovia. Reserves were estimated to be about 900 Mt containing 37% iron (Ministry of Lands, Mines and Energy, 2008a).

The contract for the redevelopment of the Bong Range iron ore deposits (formerly known as the Bong Mines) was awarded to China Union Company Ltd. in late 2008. The Inter-ministerial Mineral Technical Committee (IMTC), which awarded the contract to China Union, was chaired by the National Investment Commission and comprised representatives from the Ministries of Finance; Justice; Labor; Lands, Mines and Energy; and State. China Union's bid included a total investment of $2.6 billion and an upfront payment of $40 million compared with $36 million offered by Vedanta Resources plc of India and $20 million offered by BSG Resources Ltd. of Israel, which were the two other companies competing for the contract. Belleh Resource Co. of Liberia did not meet the requirements established by the Government and was disqualified from the process. China Union's development plans for the Bong Range included the construction of a 130-megawatt hydroelectric powerplant on the St. Paul River, a modern residential area for employees of the company, an agricultural site to grow rice and other crops, and a park to raise livestock. About 3,000 direct jobs and 5,000 indirect jobs were expected to be created within a 5-year period. No timeframe as to when the project

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was expected to begin production or additional details of other investments were provided as of yearend (Africa Mining Intelligence, 2008; AllAfrica Global Media, 2008a, c, d).

In October 2008, the Government granted MRR a 2-year exploration license extension for the Putu iron ore prospect in Grand Gedeh County, eastern Liberia. The Putu prospect consists of two prominent iron ore ridges, namely Mt. Ghi and Mt. Jideh, which potentially hosted 500 Mt of iron ore containing 60% iron as reported by Liberian-American-Swedish Mining Co. and Bong Mining Co. in the 1950s and 1960s. In 2007, an independent technical report for Putu, which was conducted by SRK Consulting Ltd., concluded that the prospect's potential iron ore resource was likely to contain 400 Mt more than was estimated during the 1950s and 1960s, therefore raising the iron ore resource potential of the Putu prospect to 900 Mt. In December 2008, MRR signed development and financial agreements with OAO Severstal Resources of Russia (Severstal) under which Severstal was to pay $12.5 million for a 25% share in African Iron Ore Group (AIOG), which was MRR's subsidiary in Liberia. Severstal paid MRR $8.3 million in December, and the balance of $4.2 million was deferred until December 2010. AIOG was renamed Severstal Liberia Iron Ore Ltd. (SLIO). Following the purchase, Severstal held a 61.5% interest in SLIO and MRR held the remaining 38.5% interest. A 3,960-m drilling program for geologic characterization was completed at Putu as of yearend. Assays from 9 out of the 11 holes drilled included the intersection of hematite mineralization of 63 m at an average grade of 63.5% iron and the intersection of magnetite mineralization of 367 m at an average grade of 39% iron. MRR planned to initiate talks with the Government in 2009 to apply for a 25-year mineral development agreement. The company envisioned beginning work on the development of the Putu prospect by 2012 with production of 20 million metric tons per year of magnetite concentrate targeted for 2015 (African Aura Mining Inc., 2007, 2008a).

Industrial Minerals

Cement.—Scancem International ANS of Norway, through Liberia Cement Corp. (Cemenco), was the sole producer of cement in Liberia. The company, which had held the monopoly on cement production since 1978, operated one grinding plant in Monrovia that produced portland cement and employed at least 63 people. Scancem held a 62% interest Cemenco. The nameplate production capacity of the plant was 220,000 metric tons per year.

Diamond.—Trans Hex Group Ltd. of South Africa in joint venture with Stellar Diamond Ltd. completed bulk sampling of five of the six known kimberlites on the Kpo Range diamond concession in 2008. Tran Hex reported that after initial analysis of the bulk samples, the kimberlite pipes proved to be uneconomical. The joint-venture partners planned to continue exploration work on new kimberlite targets in 2009 (Trans Hex Group Ltd., 2009, p. 14).

Mineral Fuels

Petroleum.—The Government opened a second petroleum licensing round for exploration acreage offshore Liberia. Three international petroleum companies—Texas-based Anadarko Petroleum Corp., Mittal Investments S.A.R.L. of Luxembourg, and Hong Kong Tong Tai Petroleum International Corp.—bid for a total of five blocks. Anadarko and Hong Kong Tong Tai emerged as the winners of the round; Anadarko obtained the rights to explore Block LB-10 and Hong Kong Tong Tai obtained the rights to explore Blocks LB-6 and LB-7. United Kingdom-based European Hydrocarbons Ltd., Repsol YPF S.A. of Spain, and Woodside Petroleum Corp. of Australia entered into production-sharing contracts with the National Oil Company of Liberia for Blocks LB-15, LB-16, and LB-17. The companies were granted petroleum exploration agreements in August 2008. Other companies exploring for petroleum offshore Liberia included Broadway Consolidated plc of the United Kingdom and Oranto Petroleum Ltd. of Nigeria. Broadway Consolidated was granted exclusive petroleum exploration rights to Block LB-13 and Oranto Petroleum was given the rights to Blocks LB-11 and LB-12 and for in 2007 (AllAfrica Global Media, 2008f; Ministry of Lands, Mines and Energy, 2008b; 2009; National Oil Company of Liberia, undated).

Outlook

If plans to redevelop the country's iron ore resources and to develop its diamond, gold, and petroleum resources come to fruition, the mineral sector in Liberia is likely to become one of the country's main sources of foreign exchange and of employment in the next 5 to 10 years. The Government's plans to establish a new mineral policy and to develop a mining cadastre suggest that the country is on its way to establishing a transparent investment climate, which is likely to attract foreign direct investments in the mineral sector. The presence of multinational corporations engaged in petroleum exploration, such as Repsol YPF and Woodside Petroleum, among others, suggest that foreign direct investment in the mining sector is likely to continue to grow in the coming years. This, however, will depend on the implementation of a predictable and transparent legal framework that adequately defines the rights and obligations of investors and on guarantees from the Government on the security of tenure of mining permits.

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TABLE 1
LIBERIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
Cement, hydraulic		121,059	143,847	135,486	157,200	94,037
Diamond	carats	10,000 e	NA [2]	NA [2]	21,700 [3]	60,536 [4]
Gold, mine output, Au content	kilograms	110 [5]	27	9	311	624
Sand		213,892 [5]	222,274 [5]	220,000 e	220,000 e	220,000 e
Stone, crushed		NA	5,964 [5]	6,000 e	6,000 e	6,000 e

eEstimated; estimated data are rounded to no more than three significant digits. NA Not available.
[1]Table includes data available through October 6, 2009.
[2]Exports of diamond under United Nations Security Council sanctions.
[3]Source: Kimberley Process Certification Scheme.
[4]Source: Central Bank of Liberia.
[5]Source: Ministry of Lands, Mines, and Energy of Liberia.

TABLE 2
LIBERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Liberia Cement Corp. Ltd. (Scancem International ANS, 62%, and Government, 29%)	Monrovia	220
Iron ore	Kkaf Nigeria Ltd.	Bong Mines (under discussions for redevelopment)	NA

NA Not available.

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The Mineral Industry of Libya

By Mowafa Taib

Crude oil and natural gas were Libya's major contributions to the world's mineral production in 2008. Libya produced 2.2% of the world's crude oil output and was ranked 4th among African countries and 17th globally in terms of the volume of crude oil produced. Libya produced 15.9 billion cubic meters of natural gas, which was about 0.5% of the world supply of gas. Libya was the leading country in Africa and the world's seventh ranked country in terms of the size of its crude oil reserves, which were estimated to be 43.7 billion barrels, or 3.5% of the world's total crude oil reserves. Libya held 1.54 trillion cubic meters of natural gas reserves, which was about 0.8% of the world's total (BP p.l.c., 2009, p. 6, 8, 22, 24).

Minerals in the National Economy

The Libyan economy continued its expansion in 2008. It grew, in real terms, at a rate of 6.7% compared with a growth rate of 6.8% in 2007 and 10.3% in 2005. The growth in the hydrocarbon sector was 3.8% compared with a growth of 11.0% in the nonhydrocarbon sector in 2008. The value of exports increased to $62.0 billion from $47.0 billion in 2007. The 32% increase in the value of exports was attributable to higher crude oil prices in 2008, which averaged for Libya $96.40 per barrel compared with $71.60 per barrel in 2007. Libya's hydrocarbon exports were valued at $60.7 billion, which was 98% of the country's total exports. In 2008, the Government revenue from the hydrocarbon sector was equivalent to 57.4% of Libya's gross domestic product (GDP) compared with 6.6% of the GDP for the revenue from the nonhydrocarbon sector (International Monetary Fund, 2009a, p. 36, 38, 47; 2009b, p. 18, 20).

Petroleum Law No. 25 of 1955, the Petroleum Regulations No. 8 and 9, and the provisions of the 5-year Exploration and Production-Sharing Agreement IV govern the hydrocarbon sector. Mining and quarrying operations are covered under law No. 2 of 1971 and its amendments, whereas law No. 5 of 1997 regulates foreign investment in the non-oil sectors. Additionally, law No. 443 of 2006 also applies to international companies, including hydrocarbons and minerals companies that intend to operate in Libya. This legislation requires foreign companies to have a local partner that holds a minimum of a 35% share in any joint venture. Government-owned National Oil Corp. (NOC), which played a dual role as a regulator and a production partner in the hydrocarbon sector, had conducted four rounds of oil licensing between January 2005 and December 2007 and did not expect to conduct any further rounds in the near future. The Libyan Mining Co. was created by Decree No. 151 of the General People's Committee in 1996 to invest in the country's natural resources and minerals, to meet the national demand for minerals by the domestic industries, and to attract foreign investment in the mining sector (Middle East Economic Digest, 2009).

Structure of the Mineral Industry

In 2008, more than 50 international oil companies (IOCs) were working on oil and gas production and exploration in Libya. NOC sought to renew the 5-year Exploration and Production-Sharing Agreement IV with the IOCs before the agreements expired. It signed a renewal agreement with Eni S.p.A. of Italy in June 2008, which permitted Eni to cut production from its main fields in Libya by 50%. Production agreements between NOC and other IOCs, including OMV AG, Repsol YPF S.A. of Spain, and Total S.A. of France, were reviewed and resulted in a lower share of oil production (13%) from Block NC-115 and Block NC-186. A disagreement between NOC and China National Petroleum Corp. (CNPC) was reported in 2008 because CNPC agreed to acquire Verenex Energy Inc. of Canada, including its assets in Libya. Verenex had been working on gas and oil exploration in the Ghadames Basin since 2006 and had reported several discoveries. The Government, through NOC, objected to the acquisition and proposed to buy Venerex assets in Libya (Organization of Arab Petroleum Exporting Countries, 2008, p. 96; Middle East Economic Digest, 2009, p. 30).

The share of NOC ownership in the companies that produced oil in Libya in 2008 ranged from 50% to 100%. NOC owned 100% of both Arabian Gulf Oil Co. and Sirte Oil Co.; had 88% interest in Akakus Oil Operations (a subsidiary of Harouge Oil Co., Repsol, and Zuweitina Oil Co.); 85.5% interest in Mellitah Oil Co.; 65% interest in OMV Libya; 60% interest in Mellitah Gas Co.; 59.2% interest in Waha Oil Co.; 51% interest in Wintershall Libya; and 50% interest in Mabruk Oil Co. (a subsidiary of Total) (table 2; Central Bank of Libya, 2009).

Government-owned Libyan Iron and Steel Co. (LISCO) was the sole producer of iron and steel products in the country. LISCO had been on the Government's list for privatization since 2005. Because of its relatively large size (6,770 employees), however, privatization was not carried out as of yearend 2008.

Production

In 2008, Libya's crude oil production decreased by 10.2 million barrels (Mbbl), or by 1.6% compared with that of 2007. The decrease in crude oil production was attributable to the decision taken in October 2008 by the Organization of the Petroleum Exporting Countries (OPEC), of which Libya was a member, to cut crude oil production by 5%. Gross natural gas production increased by 3.6% compared with 2007, thus extending the upward trend in gas production that started in 2004. There was a slight decrease in the production of refined petroleum and petrochemical products in 2008 with the exception of methanol, which increased by 12% compared with production in 2007. Cement production, which increased by 30%, continued the upward trend that started in 2003, and sulfur production increased by 20%. Notable production decreases included urea

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(23%), ammonia (20%), crude steel (9.0%), and direct-reduced iron (DRI) (5.5%) (table 1; Central Bank of Libya, 2009, p. 47).

Commodity Review

Metals

Iron and Steel.—According to the World Steel Association (WSA), Libya produced 1.57 million metric tons (Mt) of DRI, including hot-briquetted iron, compared with 1.66 Mt in 2007. WSA also reported that Libya's crude steel production was 1.14 Mt in 2008 compared with 1.25 Mt in 2007 (World Steel Association, 2009).

The volume of steel products exports in 2008 was 680,000 metric tons (t), including 320,000 t of hot-rolled products, 280,000 t of hot-briquetted iron, 48,000 t of DRI, 8,000 t of steel sections, 4,400 t of cold-rolled steel, 2,100 t of pickle steel coils, and 1,400 t of galvanized steel. The export volume was significantly less than that of 2007, especially for hot-rolled coils and sheets, which decreased by 15%; hot-briquetted iron, 34%; DRI, 66%; and steel sections, 78%. The demand increase by the local market because of the construction boom was the main reason for the decrease in steel products exports. In 2007, LISCO approved an expansion plan that was prepared by Dastur Engineering International GmbH of India to increase its crude steel production capacity to 4.2 million metric tons per year (Mt/yr) from 1.3 Mt/yr. The implementation of the expansion plan was underway in 2008 (Arab Steel, 2009; Libyan Iron and Steel Co., 2009).

Industrial Minerals

Cement.—Production of cement had been on the increase in the past few years; however, the rate of increase did not match Libya's growing demand for cement because of the extensive infrastructure development programs that the country was undertaking. Imported cement was used to satisfy the high demand of the local market. In 2008, Tunisia reported exporting about 1.7 Mt of cement, the majority of which was destined for Libya (Central Bank of Tunisia, 2009, p. 133, 137). The Government planned nearly to double its cement production capacity to 15 Mt/yr by 2011 from the current estimated capacity of 8 Mt/yr.

In October 2007, Asamer Group of Austria and the Government-owned Economic Social Development Fund (ESDF) formed a joint venture, the Libyan Manufacturing Joint Venture Co. (JLCC). In 2008, JLCC acquired 90% equity interest in the Libyan Cement Co., which owned and operated cement plants at Bengazi, El Fatayah, and Hawari, all of which are located in eastern Libya. JLCC planned to invest about $100 million on replacing outdated machinery, installing filters to reduce dust emissions, and maximizing productivity to reach full capacity by yearend 2009. In the second phase of expansion, JICC planned to double its production capacity to 6 Mt/yr by 2012 by adding a third production line to each of the three plants (Tripoli Post, The, 2008).

In 2008, Italcementi Group of Italy signed an agreement with ESDF to build a new greenfield cement plant in Al-Ghazala, which is located 53 kilometers (km) west of the city of Tubruq, northeastern Libya. The plant, which was expected to start production by yearend 2012 at a cost of between $550 million and $750 million, was expected to produce 4 Mt of portland cement with an option of producing 500,000 t of white cement annually (Maggoria, 2009).

In May 2008, state-owned African Cement Co. awarded China Building Material Co. of Hong Kong a contract to build a 1-Mt/yr clinker production capacity plant at Fezzan in the Wadi Ash-Shatti district, which is located in western Libya. The plant would take 2 years to complete at a cost of about $99 million; ESDF would have 40% interest in the project (Reuters, 2008).

Mineral Fuels

Natural Gas and Petroleum.—More than 10 companies contributed to the 643.6 Mbbl of crude oil (686 Mbbl crude plus liquids) produced by Libya in 2008. They comprised Gulf Oil Co., which produced 158.1 Mbbl; Waha Oil Co., 127 Mbbl; Akakus Oil Operations, 110.5 Mbbl; Mellitah Oil Co., 107 Mbbl; Wintershall Libya, 40 Mbbl; Harouge., 34.8 Mbbl; Sirte Oil, 33.4 Mbbl; Zuweitina Oil Co., 20.9 Mbbl; Mabruk Oil Co., 11.6 Mbbl; and OMV Libya, 0.3 Mbbl (Central Bank of Libya, 2009).

Under the Exploration and Production-Sharing Agreement IV gas exploration license bidding round that was announced in December 2007, NOC awarded an alliance of Occidental Petroleum Corp. (80%) of the United States and Liwa Energy Ltd. (20%) of the United Arab Emirates a permit to explore for gas in the onshore Block 103 of Sirte Basin. The alliance was expected to invest more than $70 million in exploration work. Occidental was the operator. Another agreement was signed between NOC and Royal Dutch Shell plc to conduct seismic mapping of a 1,750-square-kilometer (km^2) area, drill six exploration wells, and invest more than $95 million in exploration activity. Exxon Mobil Corp. (ExxonMobil) of the United States and NOC signed a production-sharing agreement to explore for gas and oil in Area 21, which consisted of four blocks and covered 100,000 km^2 offshore Sirte Basin. ExxonMobil was to conduct 4,000 km of two-dimensional (2-D) seismic mapping and 2,000 km^2 of three-dimensional (3-D) seismic mapping worth about $97 million. An alliance of Indian Oil Corp., Oil India Ltd., and Sonatrach S.p.A. of Algeria, signed a $152 million exploration and production-sharing agreement with NOC for an area located in the Ghadames Basin, which involved conducting 2,000 km of 2-D seismic mapping and 2,600 km^2 of 3-D seismic mapping.

In 2008, NOC and Shell moved forward on building a new liquefied natural gas (LNG) plant at Ras Lanuf complex, which was estimated to cost $400 million. NOC also planned to increase the capacity of its existing LNG plant in Mersa El-Brega, which was built by ExxonMobil in 1971.

Gazprom Libya BV (a subsidiary of OAO Gazprom of Russia) was awarded an exploration license for several blocks in Libya and was expected to invest more than $100 million in exploration and discovery activities. Gazprom commissioned WesternGeco (a geophysical service unit of Schlumberger Ltd. of the United States) to carry out 3-D seismic mapping of a 3,400-km^2 area in

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the Ghadames Basin (LNG Journal, 2008, p. 1; Organization of Arab Petroleum Exporting Countries, 2008, p. 96).

Outlook

The rate of growth of the mineral industry of Libya will depend on the world's hydrocarbon prices and on the degree of risk that the IOCs can take by continuing to invest in Libya. Libya' ranking among oil producing countries in Africa fell to fourth (from third), following Angola, Nigeria, and Algeria, and NOC's long-term goal of reaching a production level of 3 million barrels per day (Mbbl/d) by 2015 had been revised down to 2.3 Mbbl/d by 2013 (U.S. Energy Information Administration, 2009). These developments may encourage the Government, which is planning to invest more than $10 billion in the hydrocarbon industry in 2009, to formulate a clear policy and transparent procedures that would reassure international investors and raise their confidence in the stability of the county's laws and regulations. Mining can be one aspect of achieving diversity in the Libyan economy and in reducing its dependence on the hydrocarbon industry by attracting investment in metals production, such as iron ore and steel, and industrial metals production, such as calcium carbonate, cement, fertilizer, and gypsum.

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TABLE 1
LIBYA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Iron and steel, metal:						
Direct-reduced iron[3]		1,586	1,669	1,663	1,660	1,569
Crude steel		1,026	1,255	1,151	1,250	1,137
INDUSTRIAL MINERALS						
Cement, hydraulic[e]		3,600	3,621 [4]	5,300	6,000	8,000
Gypsum[e]		175	175	200	240	250
Lime[e]		250	250	250	250	250
Nitrogen:						
N content of ammonia		516 [r, 4]	513 [r, 4]	518 [r, 4]	524 [r, 4]	417
N content of urea		382 [r, 4]	384 [r, 4]	381 [r, 4]	359 [r, 4]	277
Salt[e]		40	40	40	40	40
Sulfur, byproduct of petroleum and natural gas[e]		15	16	128	128	142
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	14,926 [r, 4]	21,674 [r, 4]	26,847 [r, 4]	29,008 [r, 4]	30,302
Dry	do.	8,060	11,300	13,195	15,280	15,900
Methanol		600	595	657 [r]	609 [r]	680
Petroleum:						
Crude	thousand 42-gallon barrels	591,000	618,000	643,000	653,800 [r, 4]	643,600
Refinery products:						
Liquefied petroleum gas	do.	2,216 [r]	1,937 [r]	2,274 [r]	2,308 [r]	26,777
Gasoline	do.	6,540 [r]	8,000 [r]	7,580 [r]	8,130 [r]	7,750
Naphtha	do.	21,029 [r]	23,545 [r]	23,162 [r]	2,275 [r]	21,888
Kerosene and jet fuel	do.	11,107 [r]	11,810 [r]	11,028 [r]	11,613 [r]	11,937
Distillate fuel oil	do.	28,661 [r]	30,616 [r]	30,616 [r]	30,862 [r]	28,684
Residual fuel oil	do.	42,830 [r]	47,179 [r]	46,973 [r]	46,647 [r]	46,320
Total	do.	112,383 [r]	123,087 [r]	121,633 [r]	101,835 [r]	143,356

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto.

[1]Table includes data available through September 30, 2009.

[2]In addition to the commodities listed, a variety of clay, dolomite, limestone, sand, and crushed construction stone was produced, and natron (soda ash) may have been produced, but available information is inadequate to make estimates of output. Natural gas liquids also were produced but were blended with crude petroleum and reported as part of that total.

[3]Includes hot-briquetted iron.

[4]Reported figure.

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TABLE 2
LIBYA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Libyan Cement Co. [Libyan Manufacturing Joint Venture Co. (JLCC), 90%, and plant employees, 10%]	Benghazi	1,000
Do.		do.	El Fataih, Derna	1,000
Do.		do.	El Hawari	1,000
Do.		Arab Union Contracting Co.	Burj Cement plant, Zliten	1,400
Do.		Ahlia Cement Co.	Homs 2, Lebda	1,000
Do.		do.	Souk el Khamis, Tripoli	1,000
Do.		do.	Zliten	1,000
Do.		Libyan Cement Co. (LCC)	El Fataih, Derna	1,000
Do.		do.	El Hawari	1,000
Do.		Ahlia Cement Co.	Homs 1, El Margueb	300
Iron and steel:				
Iron:				
Hot-briquetted iron		Libyan Iron and Steel Co. (Government, 100%)	Misuratah	650
Sponge iron		do.	do.	1,100
Steel:				
Crude		do.	do.	1,241
Rolled:				
Bar and rod		do.	do.	800
Cold-rolled strip		do.	do.	140
Hot-rolled strip		do.	do.	580
Methanol		Sirte Oil Co. [National Oil Corp. (NOC), 100%]	Marsa El Brega	365
Natural gas, liquefied		do.	do.	700
Nitrogen:				
Ammonia		do.	do.	803
Urea		do.	do.	1,041
Petroleum:				
Crude	thousand 42-gallon barrels	Mellitah Oil Co. [National Oil Corp. (NOC), 85%, and Eni S.p.A., 15%]	Oilfields include the Bhar Essalam, the Bouri, the Bu Attifel, the El Feel, KK, NC-125, NC-169, NC-174, OO-82, the Rimal, UU-82, XX-82, the Wafa	107,000
Do.	do.	National Oil Corp. (NOC) (Government, 100%)	Oilfields include the Ali, the Almas, the Amal, the Ar Rchmat, the Aswad, the Balat, the Beda, the Belhedan, the Bualwan, the Bu Mras, the Choboc, the Deba, the Dahra, the Dor Mansour, the Ed Dib, the El-Meheiriga, the Eteila, the Facha, the Farigh, the Farrud, the Fidaa, the Ghani, the Ghazzaun, the Gsur, the Hakim, the Hamada NC5, the Hamada NC8, the Harash, the Jebel, the Jofra, the Khalifa, the Kotla, the the Lehib Dor Marada, the Mabruk, the Magid, the Masrab, the Maeghil, the Mellugh, the Messla, the Nafoora Non-unit, the Nasser, the Rakb, the Ralah, the RR-82, Sabah, the Safsaf, the Sahabi, the Samah, the Shatirah, the Tibisti, the Tmed, the Wadi, the Zaggut, the Zella, and the Zenad	117,500
Do.	do.	Arabian Gulf Oil Co. [National Oil Corp. (NOC), 100%]	Oilfields include the Sarir and the Nagoora Augila	158,100

See footnotes at the end of the table

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TABLE 2—Continued
LIBYA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:				
Crude—Continued	thousand 42-gallon barrels	Sirte Oil Co. [National Oil Corp. (NOC), 100%]	Oilfields include the Assumud, the Attahadi, and the Raguba	33,400
Do.	do.	Harouge Oil Operations [National Oil Corp. (NOC), 88%, and Petro-Canada, 12%]	Oilfields include the En Naga North and the En Naga West	34,800
Do.	do.	Mabruk Oil Operations [National Oil Corp. (NOC), 50%, and Total S.A., 50%]	Al Jurf oilfield	11,600
Do.	do.	Wintershall Libya [National Oil Corp. (NOC), 51%, and Wintershall AG, 49%]	Oilfields include the As-Sarah, the Hamid, the Jakhir, the Nakhla, and the Tauma	40,000
Do.	do.	Waha Oil Co. [National Oil Corp. (NOC), 59.2%, and ConocoPhillips Co., Marathon Oil Corp., and Amerada Hess Corp., 40.8%]	Oilfields include the Bahi, the Defa, the Gialo, and the Waha	127,000
Do.	do.	Zuweitina Oil Co., [National Oil Corp. (NOC), 88%, and OMV A.G, 12%]	Intisar oilfield	20,900
Do.	do.	Akakus Oil Operations [National Oil Corp. (NOC), 88%, and Repsol YPF S.A., 12%]	NR186 oilfield in Murzuq Basin	110,500
Refined	do.	Ras Lanuf Oil and Gas Processing Co. [National Oil Corp. (NOC)]	Ras Lanuf	80,300
Do.	do.	Az Zawiya Oil Refining Co. [National Oil Corp. (NOC)]	Az Zawiya	44,000
Do.	do.	Arabian Gulf Oil Co. [National Oil Corp. (NOC)]	Tobruk	7,300
Do.	do.	do.	Sarir	3,650
Do.	do.	National Oil Corp. (NOC)	Marsa el Brega	3,000

Do., do. Ditto.

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The Mineral Industry of Madagascar

By Thomas R. Yager

Madagascar played a significant role in the world's production of gemstones in early 2008. The country was one of the world's top-ranked sapphire producers. Starting in March 2008, gemstone production decreased precipitously because of the Government's ban on rough gemstone exports. Gemstone production decreased in other countries because of the worldwide economic crisis in late 2008; Madagascar's significance to the world gemstone industry was unclear at yearend. Other domestically significant minerals produced included chromite and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2008.

Minerals in the National Economy

In 2008, the manufacturing sector accounted for an estimated 13.2% of the gross domestic product, and the mining and construction materials sector accounted for 0.7%. In early 2008, an estimated 50,000 miners were working at the Ilakaka sapphire mines; employment in the mining industry probably declined sharply later in the year (Ministry of the Economy, Commerce, and Industry, 2008, p. 114; Cartier, 2009).

Production

In 2008, cement production increased by an estimated 70%; gold, by an estimated 44%; and limestone, by an estimated 14%. Emerald production decreased by an estimated 96% in 2008; ruby and sapphire, by an estimated 82% each; quartz, by 46%; and chromite, by 31%. The country began producing crude petroleum, ilmenite, rutile, and zircon in 2008. The country's petroleum refinery was shut down in 2005. Data on mineral production are in table 1.

Structure of the Mineral Industry

Most of Madagascar's mining and mineral processing operations were privately owned, including the gemstone, graphite, and salt mines and the cement plant. Artisanal miners produced gemstones and gold. State-owned Kraomita Malagasy SA (KRAOMA) was the country's only chromite producer. Table 2 lists major mineral industry facilities in Madagascar.

Commodity Review

Metals

Bauxite and Alumina.—In November 2006, Alcan Inc. of Canada signed a joint-venture agreement with Access Madagascar Sarl, which held the mineral rights for the Manantenina bauxite deposit in southeastern Madagascar. The companies planned to complete a concept study of the development of an alumina refinery with an initial capacity of 1.5 million metric tons per year (Mt/yr) and of a bauxite mine. The capacity of the alumina refinery could increase to 3 Mt/yr in the second phase of the project. Rio Tinto Group purchased Alcan in 2007 (Ranjatoelina, 2008).

Chromium.—KRAOMA produced chromite concentrates and lumpy ore from the Bemanevika Mine, which was estimated to have a remaining life of 15 years. The Ankazotaolana Mine was shut down in 2007 after its reserves were depleted. In 2008, KRAOMA's chromite production amounted to 84,000 metric tons (t) compared with a revised 122,260 t in 2007. KRAOMA shut down mining operations at Bemanevika in October 2008 (Ranjatoelina, 2008; Rahaga, 2009).

Cobalt and Nickel.—Starting in 2010, a joint venture of Sherritt International Corp. of Canada (40%), Sumitomo Corp. of Japan (27.5%), Korea Resources Corp. of the Republic of Korea (27.5%), and SNC-Lavalin Inc. of Canada (5%) planned to mine two nickel-cobalt deposits at Ambatovy. Lateritic slurry from the Ambatovy ore-processing plant was to be processed at a pressure-acid-leaching plant at Toamasina. The plant was expected to produce a sulfide product that contained 55.2% nickel and 4.2% cobalt. The sulfide product would be processed at a refinery with a capacity of 60,000 metric tons per year (t/yr) of refined nickel and 5,600 t/yr of cobalt; the mine was expected to start production in 2010 and to reach full production in 2012. Capital costs of the mine, pipeline, processing plants, refinery, power supply, and port facilities were estimated to be $3.3 billion. The life of the project was estimated to be 27 years (Mining Journal, 2005; Ranjatoelina, 2008).

Diamond Fields International Ltd. (DFI) of Canada purchased the exploration rights for the Valozoro nickel laterite deposit in south-central Madagascar. Previous estimates of resources at Valozoro amounted to 3.6 million metric tons at a grade of 1.75% nickel. DFI planned to provide an updated resource estimate by the end of February 2009. In the second quarter of 2008, NGM Resources Ltd. of Australia engaged in stream sediment sampling at Ambolotarabe, Londokomanana, and Maralambo (NGM Resources Ltd., 2008; Diamond Fields International Ltd., 2009).

Copper and Platinum-Group Metals.—Jubilee Platinum plc of the United Kingdom explored at its Ranomena nickel-copper-platinum group metals prospect in 2008. Malagasy Minerals Ltd. (MML) of Australia conducted sampling programs at the Ampanihy nickel-copper and the Vohibory copper-silver properties in 2008; the company planned to drill at Ampanihy and Vohibory in the first half of 2009 (NGM Resources Ltd., 2008; Pascoe, 2009).

Gold.—In 2008, Ara Minerals of Israel and KRAOMA were awarded the right to develop the Betsiaka gold deposit in northern Madagascar. Ara planned to invest $26.6 million in exploration during a period of 2 years; the company planned to commence a drilling program in 2009 (Ranjatoelina, 2009).

Pencari Mining Corp. of Canada started drilling at Itea in central Madagascar in March; the company also held the East Fianar, the Ejeda, the P49, and the Tsididy properties.

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Majescor Resources Inc. of Canada explored for gold; Sunridge Gold Corp. of Canada acquired Majescor's properties in October. Uranium Star Corp. of Canada engaged in stream sediment sampling at Ianapera. Golden Deeps Ltd. of Australia decided to relinquish its Kelimaizina property in north-central Madagascar in 2008 (Saywell, 2008; Ranjatoelina, 2009; Uranium Star Corp., 2009, p. 9).

Titanium and Zirconium.—QIT Madagascar Minerals SA [QIT Fer et Titane of Canada (a subsidiary of Rio Tinto plc), 80%, and the Government of Madagascar, 20%] started production of ilmenite, rutile, and zircon at Mandena in southeastern Madagascar at the end of December 2008. The company planned to produce 750,000 t/yr of ilmenite, 25,000 t/yr of zircon, and 15,000 t/yr of rutile. The ilmenite had a grade of 60% titanium dioxide (TiO_2). Shipments of ilmenite to Canada for smelting were expected to start by March 2009. Production could increase to 2 Mt/yr of ilmenite starting in 2012. The life of the mine was estimated to be 40 years (Kotze, 2008; Industrial Minerals, 2009).

At the end of 2008, Exxaro Resources Ltd. of South Africa and Madagascar Resources NL of Australia were engaged in a feasibility study of mining the Ranobe mineral sands deposit. The companies continued pilot processing that started in 2007. Depending upon the results of the study, a new mine could be built with a capacity of 560,000 t/yr of ilmenite at a grade of 50% TiO_2, 140,000 t/yr of ilmenite at a grade of 58% TiO_2, 44,000 t/yr of zircon, and 10,000 t/yr of rutile. The life of the mine was expected to be about 25 years. Capital costs were projected to be $250 million (Ranjatoelina, 2008, 2009).

Vanadium.—Uranium Star explored for gold at its Three Horses property; the company started a drilling program in October 2008. Vanadium mineralization was discovered at Three Horses in the fourth quarter of 2008. Uranium Star planned further exploration for vanadium in 2009; the planned exploration budget for the company's properties in 2008 and 2009 was $3.1 million (Uranium Star Corp., 2009, p. 8-10).

Industrial Minerals

Cement and Stone, Crushed.—Holcim (Madagascar) S.A. had cement plants at Ibity and Toamasina. In 2008, Holcim was producing cement at Ibity at an annual rate of 150,000 t/yr. The company planned to replace the Ibity plant with a new plant in early 2011. The new plant was expected to have a capacity of 800,000 t/yr and to cost $200 million (Madagascar Tribune, 2008; Rakotomalala, 2008a).

In June 2008, Madagascar Long Cimenterie (Maloci) of China completed a new cement plant at Ambohimanambola with a capacity of 300,000 t/yr. Maloci initially produced cement from imported clinker; the company planned to build a clinker plant that would use local gypsum and limestone as raw materials. Maloci planned to open a limestone quarry at Antsirabe. Local cement prices decreased because of the opening of Maloci's new plant (Rakotomalala, 2008b).

In 2007, domestic cement consumption was 430,000 t compared with 380,000 t in 2006; Holcim's market share was estimated to be 63%. Madagascar's cement demand was expected to double by 2018 because of growth in the construction sector. Cement was imported from China (Rakotomalala, 2008a).

Gemstones.—Madagascar was one of the world's leading producers of sapphire; most domestically mined sapphire was produced by artisanal miners at Ilakaka, Manombe, and Sakara in the south-central part of the country. From 2005 to 2007, reported sapphire exports increased to 5,124 kilograms (kg) from 4,361 kg; the increase may be attributable to the discovery of new sapphire deposits at Marosely, which is located south of Ranotsara. Sapphire was also produced at Ambondromifehy in northern Madagascar (Pezzotta, 2006; Ministry of the Economy, Commerce, and Industry, 2008, p. 53; Cartier, 2009).

Tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium, and vanadium-rich color-change garnet were produced at Behara in southern Madagascar. In August 2008, about 300 miners and gemstone traders were working at Behara (Pardieu and Hughes, 2009).

Norcross Madagascar Group of the United States started mining gem-, cabochon-, and ornamental-grade amethyst near Ambatonrazaka in March 2008. Seasonal rains from December 2007 to February 2008 prevented mining from starting earlier (Norcross Madagascar Group, undated).

Emerald was mined near Mananjary in eastern Madagascar. From 2005 to 2007, reported exports of emerald increased to 137 kg from 22 kg. In July 2007, Societe Orgaco of France mined the 536-kg Heaven's Gift Emerald in matrix at the Morafeno Mine near Mananjary and exported it to Reunion later in the year. The Government asserted that the emerald was exported illegally and sued Orgaco in Reunion. In June 2008, the court ruled that Orgaco had exported the emerald legally (Ministry of the Economy, Commerce, and Industry, 2008, p. 53; Jarrett, 2009).

The Government instituted a ban on the export of rough gemstones at the end of February 2008 in response to the export of the Heaven's Gift Emerald; the ban was still in effect at yearend. Madagascar's lapidary industry reportedly had the capacity to cut and polish about 2% of domestic rough gemstone production. Many foreign gemstone dealers left the country and gemstone mining declined sharply after the ban was implemented (Jarrett, 2009).

A wide variety of ornamental stones, which included agate, amazonite, ammolite, aragonite, calcite, cornaline, jasper, labradorite, and quartz was also produced in Madagascar. National exports of ornamental stones increased to 8,495 t in 2007 from 1,599 t in 1997. The increase was primarily attributable to increased production of labradorite (National Institute of Statistics, 2000, p. 12; Ministry of the Economy, Commerce, and Industry, 2008, p. 53).

EUROMAD SA of Italy and Marbres et Granits de Madagascar SARL (MAGRAMA) of Italy had royalty agreements with MML to mine labradorite from the anorthosite intrusives at Ianapera and Maniry. The companies produced about 3,000 t/yr of labradorite. SQNY International of India also planned to mine labradorite at Ianapera and Maniry under a royalty agreement with MML. Total production by EUROMAD, MAGRAMA, and SQNY was expected to increase to 10,000 t/yr of labradorite after 2008. Norcross also mined labradorite near Maniry (Malagasy Minerals Ltd., 2008, p. 8-9).

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In 2007, Norcross mined agate, amazonite, calcite, jasper, and quartz. The company opened new mines that included a blue calcite mine near Antsirabe, a hematoid quartz mine near Tsiroanomandidy, and a rhodonite mine near Ampanihy in 2008. Norcross also discovered new blue quartz and rose quartz deposits in 2008 (Norcross Madagascar Group, undated).

Mineral Fuels and Related Materials

Coal.—MML engaged in drilling at Ianapera near the Sakoa coal deposit in 2008; the company planned additional drilling for 2009. In November, Uranio Ltd. of Australia purchased the Imaloto project from Coal of Africa Ltd. of South Africa. Uranio planned to commence drilling at Imaloto in 2009. Straits Resources Ltd. of Australia was considering the development of a mine at Sakoa in southern Madagascar that could produce between 3 and 5 Mt/yr (Pascoe, 2009: Piper, 2009; Ranjatoelina, 2009).

Petroleum.—At the onshore Tsimiroro block, Madagascar Oil Ltd. of the United States ran a pilot plant using steam injection to recover heavy petroleum. Production started in March 2008; Madagascar Oil planned a second phase of pilot production to increase petroleum recovery to 60% from 15%. At the start of October, the company announced that crude petroleum in place at Tsimiroro amounted to about 1.3 billion barrels (Gbbl). In September, Madagascar Oil signed a farmout agreement with Total SA of France for the Bemolanga tar sands project. The companies were considering the development of a mine at Bemolanga to produce 180,000 barrels per day for more than 30 years. Resources at Bemolanga were estimated to be 16 Gbbl of crude petroleum (Madagascar Oil Ltd., 2008; Pascoe, 2009).

Uranium.—UMC Energy plc of the United Kingdom planned to engage in surface sampling at Folakara in the second half of 2008; the company postponed plans to drill until 2009. In March 2008, Pencari held eight uranium properties in central and southern Madagascar (Saywell, 2008; UMC Energy plc, 2008).

Outlook

Madagascar's mineral industry is likely to grow significantly because of increased cement, ilmenite, labradorite, rutile, and zircon production in 2009, and the startup of cobalt and nickel production in 2010. Crushed stone and gypsum production is also likely to increase as Maloci shifts from imported to domestic clinker. Further growth in the mineral industry could result from the development of the Ranobe mineral sands deposit and the Beamlonga and the Tsimiroro petroleum projects. Gemstone production is unlikely to increase under current legislation without an increase in domestic lapidaries and the trained workers to support them.

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TABLE 1
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006[e]	2007	2008[e]
METALS						
Beryllium, beryl in quartz concentrates[e]	kilograms	12,000 [r, 3]	12,000 [r]	12,000 [r]	12,000 [r]	12,000
Chromium, marketable output:						
Chromite concentrate, gross weight[e]		21,000	36,000	32,000	30,000	21,000
Chromite ore, lumpy[e]		56,000	105,000	100,000	92,000 [r]	73,000
Total		77,386	140,847	132,335 [3]	122,260 [r]	84,000 [3]
Gold, mine output, Au content[e, 4]	kilograms	-- [r, 3]	10 [r]	30 [r]	50 [r]	72 [3]
INDUSTRIAL MINERALS						
Cement, hydraulic[e]		170,000	150,000	150,000	270,000 [3]	460,000
Clay, kaolin		NA [r]	NA [r]	NA [r]	NA [r]	NA
Gemstones:[e, 5]						
Amethyst[6]	kilograms	620	620	620	620	620
Cordierite	do.	160	160	160	160	160
Emerald	do.	53 [3, 7]	22 [r, 3, 7]	70 [r]	672 [r, 3, 7]	25
Garnet	do.	600	600	600	600	600
Ruby	do.	741 [3, 7]	840 [r, 3, 7]	400 [r]	78 [r, 3, 7]	14
Sapphire	do.	5,890 [3, 7]	4,361 [r, 3, 7]	4,700	5,124 [r, 3, 7]	940
Tourmaline[6]	do.	64,000	68,000	68,000	68,000	68,000
Graphite, all grades		7,770	6,400	4,857 [r, 3]	5,000 [r, e]	5,000
Gypsum[e]		500	500	500	500	500
Mica, phlogopite		287 [r, 7]	546 [r, 7]	1,071 [r, 3, 7]	1,349 [r, 7]	1,233 [3, 7]
Ornamental stones:[e, 5]						
Agate	kilograms	25,000	25,000	25,000	25,000	25,000
Labradorite		4,200 [r]	4,200 [r]	4,200 [r]	4,200 [r]	4,200
Quartz		436 [r, 3, 7]	141 [r, 3, 7]	1,643 [r, 3, 7]	1,596 [r, 3, 7]	867 [3, 7]
Salt, marine[e, 8]		55,000	65,000	75,000	75,000	75,000
Stone:[e]						
Dimension		NA [r]	NA [r]	NA [r]	NA [r]	NA
Limestone[9]		220,000 [r]	190,000 [r]	190,000 [r]	350,000 [r]	400,000
Marble		5,000	5,000	5,000	5,000	5,000
Titanium:						
Ilmenite concentrate		--	--	-- [3]	--	10,000
Rutile concentrate		--	--	-- [3]	--	200
Zirconium concentrate		--	--	-- [3]	--	350
MINERAL FUELS AND RELATED MATERIALS						
Petroleum:						
Crude	thousand 42-gallon barrels	--	--	-- [3]	--	14
Refinery products:						
Gasoline	do.	964 [r]	1,211 [r]	-- [3]	--	-- [3]
Kerosene and jet fuel	do.	526 [r]	373 [r]	-- [3]	--	-- [3]
Distillate fuel oil	do.	426 [r]	463 [r]	-- [3]	--	-- [3]
Residual fuel oil	do.	547 [r]	677 [r]	-- [3]	--	-- [3]
Liquified petroleum gas	do.	73 [r]	50 [r]	-- [3]	--	-- [3]
Other	do.	140 [r]	161 [r]	-- [3]	--	-- [3]
Total	do.	2,676 [r]	2,935 [r]	-- [3]	--	-- [3]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through March 10, 2010.

[2]In addition to the commodities listed, modest quantities of crude construction materials (other clays, sand and gravel, and stone), industrial abrasives and calcite, and kaolin presumably are produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Does not include smuggled artisanal production, which is estimated to be from 1,000 to 2,000 kilograms per year.

[5]Does not include smuggled artisanal production.

[6]Includes both gem and ornamental quality.

[7]Reported exports.

[8]Compagnie Salinere de Madagascar and Grand Salines de Menabe only. Other companies reportedly produced small amounts of salt.

[9]Cement producers only.

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TABLE 2
MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Holcim (Madagascar) S.A. (Holcim Group, 90%)	Plant at Toamasina	230,000.
Do.		do.	Plant at Ibity	220,000.
Do.		Madagascar Long Cimenterie (Maloci)	Plant at Ambohimanambola	300,000.
Do.		SA Nouvelle Cimenterie Amboanio (LaFarge Group, 66%, and Moustansir Ibaramdty Family, 34%)	Plant at Mahajanga[1]	50,000.[e]
Chromium		Kraomita Malagasy SA (Government, 100%)	Mine at Ankazotaolana[1]	250,000.
Do.		do.	Mine at Bemanevika[1]	200,000.[e]
Gemstones:				
Rough:				
Amethyst	kilograms	Norcross Madagascar Group	Mines at Ambatonrazaka	NA.
Emerald	do.	Artisanal and small-scale miners	Mines at Mananjary	130.[e]
Labradorite		Marbres et Granits de Madagascar SARL	Mines at Ianapera and Maniry	4,200.[e]
Do.		EUROMAD SA	do.	NA.
Do.		Norcross Madagascar Group	Mines at Maniry	1,200.[e]
Quartz		do.	Mines at Ramaratina	NA.
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000.[e]
Sapphire	do.	Various producers, including the following:	Locations:	5,000.[e]
		Artisanal and small-scale miners	Mines at Ilakaka, Manombe, Marosely, and Sakara	
		World Sapphire Group	Mines at Ilakaka	
		Tany Hafa S.A.	Mines at Sahambano	
		Canalta Gems Inc.	Mines at Nose-Be and Andovokonko	
Tourmaline	do.	Artisanal and small-scale miners	Mines at Alatsinainuy Ibity	NA.
Polished[2]	do.	Dream Stones Trading	Plant in Antananarivo	15.
Graphite		Etablissements Gallois	Artsirakambo Mine near Brickaville	4,800.
Do.		do.	Marovinsty Mine near Vatomandry	3,600.
Do.		do.	Ambalafotaka Mine	NA.
Do.		Société Minière de la Grande Ile (Graphite Technology Group Inc., 50%)	Ambatomitamba Mine near Tamatave	6,000.
Do.		do.	Ambiani, Ambodihasina, Sandraka, and Sahamaloto Mines	3,600.
Do.		Société Arséne Louys	Mine at Ambatoharanana	3,000.[e]
Do.		Etablissements Izouard	Faliarno Mine near Moramanga	2,000.
Gypsum		Compagnie Salinere de Madagascar	Antsahampano	500.
Mica		Societe des Mines d'Ampandranhava	Tolagnaro	2,000 processed.
Petroleum, crude	thousand 42-gallon barrels	Madagascar Oil Ltd.	Tsimiroro	17.[e]
Salt		Compagnie Salinere de Madagascar	Antsahampano	70,000.
Do.		Grand Salines du Menabe	Morondava	5,000.[e]

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating at the end of 2008.
[2]Includes amethyst, aquamarine, emerald, sapphire, tourmaline, and other gemstones.

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The Mineral Industry of Malawi

By Thomas R. Yager

Malawi was a producer of cement, coal, crushed stone, dolomite, kaolin, lime, and limestone for domestic consumption. The country also mined and exported ornamental stone and such gemstones as amethyst, garnet, ruby, sapphire, and tourmaline. Malawi was not a globally significant producer or consumer of minerals.

Production

In 2008, limestone production for use in the cement industry increased by an estimated 76%, and cement, by an estimated 30%. In 2007 (the latest year for which reported data were available), the production of gemstones increased by 71%; ornamental stone, 42%; and aggregates, 18%. Lime output declined by 10% (table 1).

Structure of the Mineral Industry

Most of the mining and mineral processing operations in Malawi were privately owned, including the cement plants, the Mchenga coal mine, and the Nyala ruby and sapphire mine. Small-scale and artisanal miners produced aggregates, brick clay, gemstones, and lime (table 2).

Commodity Review

Metals

Copper and Nickel.—In 2008, Lisungwe plc of the United Kingdom carried out drilling at the Chimimbe Hill property in western Malawi. Lisungwe reported in late December that the Chimimbe Hill project was subeconomic at world nickel prices of $10,000 per metric ton. The company indicated that higher nickel prices and lower production costs from mining domestic pyrite deposits to produce sulfuric acid could improve the outlook for the project. Lisungwe expected to obtain a resource estimate in January 2009 (Lisungwe plc, 2008).

In October 2008, MM Mining plc of the United Kingdom conducted a drilling program at the Ngala Hills copper prospect. MM Mining was also engaged in a joint venture with Albidon Ltd. of Australia to explore at the Mpemba Hill nickel-copper prospect (Ministry of Energy and Mines of Malawi, 2009c).

Niobium (Columbium), Tantalum, and Zirconium.—In March 2008, Globe Metals & Mining Ltd. of Australia estimated that resources at Kanyika were 56.4 million metric tons (Mt) at a grade of 0.48% zircon, 0.26% niobium pentoxide (Nb_2O_5), 0.012% tantalum pentoxide (Ta_2O_5), and 0.007% uranium oxide (U_3O_8). The company released the results of its scoping study in June (Globe Metals & Mining Ltd., 2008a; Ministry of Energy and Mines of Malawi, 2009b).

Globe was considering the development of a new mine and ferroniobium plant at Kanyika. In the company's scoping study, planned production was between 3,000 and 4,000 metric tons per year (t/yr) of niobium contained in ferroniobium, between 44 and 59 t/yr of Ta_2O_5, and between 8,500 and 13,700 t/yr of zircon. Initial capital costs were estimated to be between $156 million and $177 million. Globe started a prefeasibility study in September 2008. Depending on the results of the study, production could start in 2011 (Globe Metals & Mining Ltd., 2008a, b).

Industrial Minerals

Cement and Stone, Crushed.—Portland Cement Company Ltd. (a subsidiary of LaFarge S.A. of France) produced cement from imported clinker and gypsum. In 2008, LaFarge was engaged in a drilling program at the Chenkumbi Hills limestone deposits in the Machinga District. Depending on favorable results, LaFarge could open a new limestone quarry at Chenkumbi Hills in late 2010 or early 2011. Domestic cement prices could decline by between 15% and 20% because of the use of lower cost local raw materials (Chikoko, 2008).

Shayona Cement Corp. was producing at the rate of 55,000 t/yr of cement in late 2008. The company quarried limestone from Livwezi for use in its plant. By the end of 2009, Shayona planned to increase its cement output capacity to nearly 150,000 t/yr (Ministry of Energy and Mines of Malawi, 2009c).

Gemstones.—In July 2008, the Nyala Mine at Chimwadzulu Hill reopened after closing in early 2006. Production was nearly 4 kilograms per year (kg/yr) of gem-quality ruby and sapphire; between 5% and 10% of the mine's output was gem quality. Plans by Columbia Gem House Inc. of the United States to expand capacity to as much as 70 kg/yr of gem-quality ruby and sapphire were on hold because of the difficulties in obtaining credit during the global economic downturn (Ministry of Energy and Mines of Malawi, 2009a).

Phosphate Rock.—In mid-2008, Optichem Ltd. started trial mining at the Tundulu phosphate deposit in the Phalombe District. Optichem estimated that the use of locally mined phosphate rock could lower the price of fertilizers by at least 33%. Resources at Tundulu were estimated to be 2 Mt at a grade of 17.5% phosphorous pentoxide (P_2O_5) (Ministry of Energy and Mines of Malawi, 2009b).

Rare-Earth Elements.—Lynas Corp. Ltd. of Australia held the Kangankunde rare-earth deposit. Resources were estimated to be 2.53 Mt at a grade of 4.24% rare-earth minerals. Lynas planned to produce 5,000 t/yr of rare-earth minerals by 2012 at Kangankunde (Lynas Corp. Ltd., 2007; Curtis, 2008, p. 6).

Mineral Fuels and Related Materials

Uranium.—Paladin Resources Ltd. of Australia was engaged in the construction of a new open pit mine at the Kayelekera uranium deposit in northern Malawi. The life of the project was estimated to be 11 years; Paladin planned to produce about 1,500 t/yr of uranium oxide (U_3O_8) starting in the first quarter

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of 2009. Reserves at Kayelekera were estimated to be 10.5 Mt at a grade of 0.109% U_3O_8. The Kayelekera Mine was expected to increase Malawi's exports by 25%, and the gross domestic product, by 10% (African Mining, 2008).

In 2008, Globe Metals & Mining Ltd. of Australia conducted a drilling program at Livingstonia; the company also held the Nthalire property. Globe was considering uranium production at the Kanyika project. Africa Energy Resources Ltd. of the United Kingdom completed geochemical rock chip and soil sampling at the Majete and the Rumphi properties in May. Mantra Resources Ltd. of Australia explored at Chikangawa, Chintheche, and Nanzeka. Oropa Ltd. of Australia engaged in exploration at the Chitunde and the Mzimba Northwest properties (Globe Metals & Mining Ltd., 2008a, b; Mantra Resources Ltd., 2008, p. 18-19; Oropa Ltd., 2008, p. 14-17).

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TABLE 1
MALAWI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
Cement, hydraulic		119,500	166,000	187,600	185,300	240,000
Coal, bituminous		40,891	51,870	60,408	58,550	60,000
Dolomite[e]		5,400	5,400	5,400	5,400	5,400
Gemstones	kilograms	1,820	1,994	2,171	3,710	3,700
Kaolin[e]		660 r	790 r	920 r	1,000 r	1,000
Lime		23,095	22,733	21,147	18,965	19,000
Ornamental stone		320	72	126	179	180
Stone:						
Crushed for aggregate		168,600	171,284	191,968	226,351	230,000
Limestone, for cement		21,224	28,755 r	34,226 r	42,088 r	74,000

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised.

[1]Includes data available through August 12, 2009.

[2]In addition to commodities listed, modest quantities of brick clay, dimension stone, gypsum, phosphate rock, and salt were reportedly produced, but information is inadequate to make reliable estimates of output.

TABLE 2
MALAWI: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Portland Cement Company Ltd. (LaFarge S.A., 75.17%)	Plant at Blantyre	200,000.
Do.		Shayona Cement Corp.	Plant at Livwezi	55,000.
Coal, bituminous		Mchenga Coal Mines	Mine at Mchenga	60,000.
Dimension stone		Ilomba Granite Company Ltd.	Mine at Ilomba Hill in Chitipa District	NA.
Do.		Granite Ltd.	Mine in Mzimba District	NA.
Fertilizer		Optichem Ltd.	Plant at Blantyre	40,000.
Limestone		Shayona Cement Corp.	Mine at Livwezi	74,000.[e]
Phosphate rock		Optichem Ltd.	Mine at Tundulu	NA.
Ruby and sapphire	kilograms	Nyala Mines Ltd. (subsidiary of Columbia Gem House Inc.)	Nyala Mine at Chimwadzulu Hill	30 sapphire; 15 ruby.[e]

[e]Estimated. Do. Ditto. NA Not available.

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The Mineral Industries of Mali and Niger

By Omayra Bermúdez-Lugo

MALI

Mali's mining sector was dominated by the production of gold. No other mineral commodities were produced in significant quantities in the country, with the exception of rock salt and semiprecious stones, such as amethyst, epidote, garnet, prehnite, and quartz. Diamond was produced in small quantities as a byproduct of the mining of gold, but information on diamond production was inadequate to make reliable estimates of output. The country's vast undeveloped mineral resources included bauxite, copper, chromium, diamond, granite, gypsum, iron ore, kaolinite, lead, lithium, manganese, marble, nickel, niobium, palladium, phosphate rock, rutile, talc, tin, titanium, thorium, tungsten, silver, uranium, and zirconium.

Mali is divided into three mining districts: the west mining district, which comprises the administrative region of Kayes; the south mining district, which comprises the southern region of Koulikoro and Sikasso; and the north mining district, which comprises the regions of Gao, Kidal, and Tombouctou. The west mining district, in turn, is subdivided into four mining provinces: a mining province to the north of Kayes, which lies within the Guidimaka region; a mining province to the northeast of Kayes, which lies within the Nioro region; a mining province to the southeast of Kayes, which is host to the the Loulo, the Sadiola Hill, the Tabakoto, and the Yatela gold mines, to iron ore and uranium deposits, and to the majority of the country's known kimberlite pipes; and a mining province to the southeast of Kayes, which is host to bauxite, iron ore, limestone, and marble deposits. The south mining district is host to the Kalana and the Morila gold mines; to the Bale, the Kodieram, the Misseni, and the Syama gold deposits; and to the Bougouni lithium deposit. The north mining district is host to the Bah-el-heri and the Dimamou limestone deposits, the Darset gold deposit, the Tamaguilelt phosphate deposit, the Taoudeni salt mine, the Tassiga manganese deposit, and the Tessalit lead and zinc deposit (Direction Nationale de la Géologie et des Mines, 2008).

The Government agency responsible for the mining sector in Mali is the Direction Nationale de la Géologie et des Mines, which is part of the Ministère des Mines de l'Énergie et de l'Eau.

Production

Data on mineral production are in table 1.

Structure of the Mineral Industry

At least 17 international companies were engaged in gold exploration and production in Mali. These included Resolute Mining Ltd. of Australia; Canadian companies African Gold Group Inc., Avion Resources Corp., Avnel Gold Mining Ltd., Axmin Inc., Etruscan Resources Inc., Great Quest Metals Ltd., IAMGOLD Corp., Merrex Gold Inc., North Atlantic Resources Ltd., and Rockgate Capital Corp.; Glencar Mining plc of Ireland; AngloGold Ashanti Ltd. and Central African Gold (through Mali Gold Fields SA and Songhoi Ressources SA) of South Africa; and Cluff Gold plc and Randgold Resources Ltd. of the United Kingdom. Oklo Uranium Ltd. of Australia explored for phosphate rock and for uranium. Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom explored for bauxite. Table 2 is a list of major mineral industry facilities.

Mineral Trade

Mali's exports to the United States were valued at about $5 million in 2008 compared with about $9.5 million in 2007; gold accounted for $597,000 of these exports. Imports from the United States were valued at about $31 million in 2008 compared with about $32 million in 2007. This total included nearly $6.1 million for excavating machinery and $1.2 million for drilling and oilfield equipment (U.S. Census Bureau, 2009a, b).

Commodity Review

Metals

Gold.—Gold was produced at both the artisanal and industrial levels. Most of the artisanal gold produced in the country came from the Kenieba Valley, which is located about 500 kilometers (km) from the capital city of Bamako. Orpailleurs (artisanal gold miners) recovered gold from alluvial deposits in Kenieba and, to a lesser extent, from other areas throughout the country. At the industrial level, gold was produced from the Kalana, the Loulo, the Morila, the Sadiola Hill, the Syama, the Tabakoto, and the Yatela Mines.

Production from the Kalana underground gold mine decreased by about 15% to 666 kilograms (kg) (reported as 21,407 troy ounces) in 2008 from 789 kg (reported as 25,359 troy ounces) produced in 2007. Avnel estimated that mineral reserves from underground operations at Kalana would be depleted by 2010. The company planned to begin addressing strategies to study the potential for further gold mining in areas within the immediate proximity of the Kalana Mine (Avnel Gold Mining Ltd., 2009, p. 2).

Gold production at the Loulo Mine decreased by 2% to 8,028 kg (reported as 258,095 troy ounces) in 2008 compared with 8,231 kg (reported as 264,647 troy ounces) in 2007. The decrease in production was attributed to lower head grades caused by the delay in the development of underground deposits as the mine was being prepared to transition from an open pit operation to an underground operation (Randgold Resources Ltd., 2009, p. 20-23).

The Morila Mine produced 13,245 kg (reported as 425,828 troy ounces) compared with 13,991 kg (reported as 449,815 troy ounces) in 2007. Randgold reported that mining activities at Morila would cease by April 2009 owing to

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depletion of ore by mining. The company planned to continue to process stockpiled material until 2013 (Randgold Resources Ltd., 2009, p. 24-31).

Gold production from the Sadiola Hill open pit gold mine increased by 23% to 14,090 kg from 11,477 kg in 2007 mostly owing to improved recovery rates as a result of the commissioning of a gravity circuit in December 2007, which improved the recovery of both sulfide and oxide ore during the year (AngloGold Ashanti Ltd., 2009, p. 71).

The Tabakoto Mine remained closed during the year. The mine, which was opened in May 2006, had been put on care-and-maintenance status by its previous owner, Nevsun Resources of Canada, in September 2007. In May 2008, Avion acquired an 80% interest in the Tabakoto Mine and the Segala gold project from Nevsun. Avion planned to complete an updated resource estimate for Tabakoto by the first quarter of 2009 and to begin production at Segala shortly thereafter (Avion Resources Corp., 2008a; 2008b, p. 2-3).

Gold production from the Yatela open pit mine decreased by about 45% to 5,132 kg from the 9,362 kg produced in 2007. The decrease in production was attributed to the decline in head grade owing to the underperformance of Pushback 5 (a pushback is a pit that satisfies a number of practical mining requirements, including minimum size and access space), which led to lower grade ore being supplied for stacking at the heap-leach pads (AngloGold Ashanti Ltd., 2009, p. 72).

Mineral Fuels and Related Materials

Uranium.—Oklo Uranium completed a combined radiometric and aeromagnetic survey of an area prospective for uranium known as the Kidal project. The company was in the process of completing final interpretations and identifying specific uranium target areas at Kidal and planned to conduct ground geophysics, surface sampling, and geologic mapping to prioritize targets for drill testing (Oklo Uranium Ltd., 2009, p. 4, 10-12).

Rockgate acquired a 60% interest in the Falea project from Delta Exploration Inc. The project, which is prospective for copper, silver, and uranium, is located about 350 km west of Bamako and covers an area of 150 square kilometers (km^2). As of September 2008, the company had completed 40,000 meters of drilling on the property in 149 diamond drill holes (Rockgate Capital Corp., 2008).

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NIGER

In 2008, Niger was ranked as the world's sixth ranked producer of uranium. Other mineral commodities produced in the country included cement, coal, gold, gypsum, limestone, salt, silver, and tin (World Nuclear Association, 2009).

Production

Gold production decreased by 32% to 2,314 kg from a revised 3,427 kg produced in 2007, gypsum production increased by 88% to 8,661 metric tons (t), and silver production increased by 108% to 289 kg. Data on mineral production are in table 1.

Structure of the Mineral Industry

In addition to Paris-based Areva NC, which was the country's sole uranium producer, at least 10 companies were exploring for uranium in Niger in 2008. These companies included Artemis Resources Ltd. of Australia, which held explorations rights for 1,000 square km^2 within the Tim Mersoi Basin; Bayswater Uranium Corp.; Cameco Corp. of Canada in joint venture with Govi High Power Exploration Inc., which held exploration rights for about 2,300 km^2 in the Arlit region and 2,400 km^2 in the Agadez region; China Nuclear International Uranium Corp.; Homeland Uranium Inc. of Canada, which held the exploration rights for 3,751 km^2 in the Arlit region; Niger Uranium Ltd., which held eight prospecting licenses in Niger covering a total area of 6,773 km^2 in the Tim Mersoi Basin; North Atlantic Resources Ltd. in joint venture with Orezone Gold Corp., which together held exploration rights for 4,000 km^2 located within 40 km of the Akouta and the Arlit uranium mines; and Oklo Uranium Ltd. (Cameco Corp., 2008; Haggett, 2008; Niger Uranium Ltd., 2008; North Atlantic Resources Ltd., 2008; Artemis Resources Ltd., 2009, p. 11-12; Homeland Uranium Inc., 2009). Table 2 is a list of major mineral industry facilities.

Mineral Trade

Niger's exports to the United States were valued at about $44.3 million in 2008 compared with about $9.6 million in 2007; crude petroleum accounted for $40.9 million of these exports. Imports from the United States were valued at about $50 million in 2008 compared with about $69.3 million in 2007.

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This total included nearly $19 million in natural gas liquids, $790,000 for excavating machinery, and $89,000 for drilling and oilfield equipment (U.S. Census Bureau, 2009a, b).

Commodity Review

Industrial Minerals

Cement.—In March, HeidelbergCement AG of Germany sold its share in Société Nigérienne de Cimenterie (SNC) to Damnaz Cement Company Ltd. of Nigeria. SNC operated a cement plant in Malbaza Uzine, southwestern Niger. Niger imported about 65% of its domestic requirements of cement from Benin and Togo. Annual production capacity from Niger's only cement plant was 80,000 t (AllAfrica Global Media, 2008; HeidelbergCement AG, 2008, p. 16).

Mineral Fuels and Related Materials

Petroleum.—China National Oil and Gas Exploration and Development Corp. signed a production-sharing agreement with the Government for the development of the Agadem oilfield. Petroleum reserves at Agadem were estimated to be 324 million barrels. The agreement included the construction of a petroleum refinery in the city of Zinder with a capacity to produce 20,000 barrels per day and a 580-km pipeline linking the Agadem field to the refinery. Production was scheduled to begin in 2011. China planned to invest $5 billion in the project (Alexander's Gas & Oil Connections, 2008; International Business Times, 2008; Ross, 2008).

Uranium.—Production of uranium came from the Akouta underground mine, which was operated by Compagnie Minière d'Akouta (COMINAK), and the Arlit open pit mine, which was operated by Société des Mines de l'Aïr (SOMAIR). COMINAK was owned by Areva (34%), the Government of Niger (31%), Overseas Uranium Resources Development Co. of Japan (25%), and ENUSA Industrias Avanzadas, S.A. of Spain (10%). SOMAIR was owned by Areva (63.4%) and the Government of Niger (36.6%). About 2,000 people worked for the Akouta and the Arlit Mines, in addition to 160 employees at Areva's Niger platform based in the capital city of Niamey (Areva NC, 2009, p. 80).

In 2008, Areva continued with its plans to develop the world-class Imouraren uranium deposit at a cost of $1.4 billion. The Imouraren project is located about 160 km north of Agadez and 80 km south of Arlit. Uranium reserves at Imouraren were estimated to be 180,000 t. Areva had received an exploration permit for Imouraren in 2006 and in mid-2008 had submitted a feasibility study and an environmental impact assessment to the Government. Areva received a mining permit for the deposit in early January 2009. The mine, which was expected to begin production in 2012, would produce about 5,000 metric tons per year of uranium. Ownership in the project was to be shared between Areva and the Government, which would hold a 66.65% and a 33.35% interest, respectively (Areva NC, 2009, p. 80, 92, 195).

During the year, the Niger Movement for Justice (NMJ), which was a Tuareg-led rebel movement, kidnapped four employees from Areva's Akouta Mine. The NMJ had longstanding grievances with the Government concerning uranium-rich land in the Agadez region. The group claimed that revenues from uranium mining in Agadez were not being used for development projects in the region and demanded that up to 30% of uranium revenue be allocated to the country's northern region (Ghanmi, 2008; Magnowski and Massalatchi, 2008).

Oklo Uranium held four uranium exploration permits for the Elmeki project, which covers the western margin of the Aïr Massif. An airborne geophysical survey was conducted across the entire area of the project by the Government in collaboration with the European Community. Oklo planned to purchase the existing geophysical data to identify exploration targets, which could be followed up with ground exploration to locate targets using ground geophysics, mapping, and sampling (Oklo Uranium Ltd., 2009, p. 4, 10-12).

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TABLE 1
MALI AND NIGER: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2004	2005	2006	2007	2008
MALI[2]						
Gold, mine output, Au content[3]	kilograms	37,911	44,230	51,957	43,850	41,160
Salt[e]		6,000	6,000	6,000	6,000	6,000
Semiprecious stones[4]		NA	NA	10,000	10,000 [e]	10,000 [e]
NIGER[5]						
Cement, hydraulic[e]		59,200 [r]	83,400 [r]	62,000 [r]	42,000 [r]	40,000
Coal, bituminous		183,000 [e]	182,060	176,320	171,296	182,912
Gold, mine output, Au content	kilograms	684 [6]	4,962	2,615	3,427 [r]	2,314
Gypsum		17,700 [e]	17,417	13,043	4,615	8,661
Limestone		146,000	146,000	146,000	146,000	146,000
Salt[e]		2,000	1,269 [7]	1,300	1,300	1,300
Silver, mine output, Ag content	kilograms	NA	201	100 [e]	139 [r]	289
Sulfuric acid:[e]						
Gross weight		70,000	70,000	70,000	70,000	70,000
Sulfur content		23,000	23,000	23,000	23,000	23,000
Tin, mine output, Sn content		30 [e,r]	14	13	11	10 [e]
Uranium, U content		3,282	3,093	3,434	3,153	3,032

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. NA Not available.
[1]Table includes data available through October 7, 2009.
[2]Mali also produced sand and gravel solely for domestic consumption, but information is inadequate to make reliable estimates of output.
[3]Excludes artisanal production, which is estimated to be about 4,000 to 5,000 kilograms per year.
[4]Artisanal production of semiprecious stones includes amethyst, epidote, garnet, prehnite, and quartz.
[5]In addition to the commodities listed, phosphate rock, tungsten ore, and a variety of construction materials (clays, sand and gravel, and stone) were produced, but information is inadequate to make reliable estimates of output.
[6]Does not include production from artisanal miners.
[7]Reported figure.

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TABLE 2
MALI AND NIGER: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
MALI				
Gold	kilograms	Société de la Mine d'or de Kalana (Avnel Gold Mining Ltd., 80%, and Government, 20%)	Kalana Mine, 300 kilometers south of Bamako	900.
Do.	do.	Société des Mines de Loulo (Randgold Resources Ltd., 80%, and Government, 20%)	Loulo Mine, 350 kilometers west of Bamako	7,800.
Do.	do.	Morila S.A. [a subsidiary of Morila Ltd., 80% (AngloGold Ashanti Ltd., 40%; Randgold Resources Ltd., 40%; Government, 20%)]	Morila Mine, 180 kilometers southeast of Bamako	13,000.
Do.		Société d'Éxploitation des Mines d'Or de Sadiola S.A. (AngloGold Ashanti Ltd., 38%; IAMGOLD Corp., 38%; Government, 18%; International Finance Corporation, 6%)	Sadiola Hill Mine, 77 kilometers south of Kayes	5,300,000 ore.
Do.	kilograms	Société des Mines de Syama S.A. (Resolute Mining Ltd., 80%, and Government, 20%)	Syama Mine, 300 kilometers southeast of Bamako	7,800.
Do.	do.	Société d'Exploitation des Mines d'Or de Yatela (AngloGold Ashanti Ltd., 40%; IAMGOLD Corp., 40%; Government, 20%)	Yatela Mine, 50 kilometers southwest of Kayes	2,500,000 ore.
Do.	do.	Avion Resources Corp., 80%	Tabakoto Mine, Kenieba Valley	On maintenance.
Do.	do.	Artisanal miners	Kenieba Valley	5,000.
NIGER				
Cement		Société Nigérienne de Cimenterie (Damnaz Cement Company Ltd.)	Malbaza Uzine, southwestern Niger	80,000.
Coal		Société Nigérienne de Charbon (SONICHAR)	Anou Araren, central Agadez region	300,000.
Gold	kilograms	Société des Mines du Liptako S.A. (SML) [African GeoMin Mining Development Corp. Ltd. (which is owned by Etruscan Resources Inc., 50%, and Semafo Inc., 50%), 80%, and Government, 20%]	Samira Hill Mine, 90 kilometers west of Niamey	3,000.
Uranium		Compagnie Minière d'Akouta (COMINAK) [Areva NC, 34%; Government, 31%; Overseas Uranium Resources Development Co., 25%; ENUSA Industrias Avanzadas S.A., 10%]	Akouta underground mine, northern Niger	2,500.
Do.		Société des Mines de l'Aïr (SOMAIR) (Areva NC, 63.4%, and Government, 36.6%)	Arlit open pit mine, 6 kilometers northwest of Arlit, Agadez Region	2,300.
Do.	do.	Ditto.		

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The Mineral Industry of Mauritania

By Mowafa Taib

In 2008, Mauritania was ranked 2d in Africa after South Africa and 15th in the world in terms of the volume of its iron ore production. It was the world's seventh ranked iron ore exporting country, accounting for about 11 million metric tons (Mt) of iron ore exports. Mauritania produced modest quantities of cement, copper, gold, gypsum, and salt from its abundant mineral deposits, which also include cobalt, diamond, phosphate rock, sulfur, and uranium. In August 2008, a military coup d'état took place following national elections that started in November 2006 and ended with the inauguration of a new President in April 2007. The newly appointed Government planned to hold national elections again on June 6, 2009 (Ministry of Mines and Industry, 2008; U.S. Department of Commerce, U.S. Commercial Service, 2008, p. 14; Banque Centrale de Mauritanie, 2009, p. 49; Jorgenson, 2009, p. 81).

Minerals in the National Economy

The mineral sector's contribution to the Mauritanian economy had been about 12% of the gross domestic product (GDP) up to 2006 when oil production started. The contribution of the mineral sector jumped to 32% of the GDP in 2006 but declined to 14% in 2007 because of a 51% reduction in crude oil production in that year. In 2008, Mauritania's total exports were valued at about $1,751 million compared with $1,457 million in 2007. Iron ore exports were about 42%, by value, of total exports compared with 40% in 2007. The value of crude oil exports accounted for 19% of total exports, which was down from 23% in 2007. Gold exports composed about 10% of the country's total exports compared with 4% in 2007, and copper exports represented 10% of total exports compared with 13% in 2007. The destinations of Mauritania's iron ore exports, which in 2008 were 7.3% less by volume than those in 2007, were France (33%), Italy (14%), Germany (12%), Belgium (9%), the United Kingdom (4%), and other countries (26%) (Banque Centrale de Mauritanie, 2009).

Production

In 2008, there were notable increases in the production of gold (178%), crude steel (64%), salt (36%), and copper (5%) compared with production in 2007. There were also significant decreases in the production of cement (21%), crude oil (20%), gypsum (10%), and iron ore (7%) during the same time period. Data on mineral production are in table 1.

Structure of the Mineral Industry

The Ministère de l'Industrie et des Mines [Ministry of Mines and Industry] and the Ministère du Pétrole et de l'Energie [Ministry of Petroleum and Energy] were the Government agencies responsible for regulating mineral industry activity. The Direction des Mines et de la Géologie (Department of Mines and Geology) implemented the Government policies to enhance foreign investment in the mining sector of Mauritania. The incentives offered to foreign investors included exemption from customs duties for exploration and during the first 3 years of mining; a tax holiday for the first 3 years of production and a 25% corporate tax thereafter; and royalties that ranged from 1.5% to 5%, depending on the mineral or mineral-related commodity and the value of the final product. The Government, with the help of the French Cooperation Agency, the Islamic Development Bank, and the World Bank, developed a program that offers geophysical information on mineral deposits through the Project for Institutional Strengthening of the Mining Sector (PRISM). The first phase of the project (PRISM 1) was focused on conducting geologic surveys in the Central Zone, the Extreme South Zone, the Northern Zone, and the Northwest Zone. During the second phase, PRISM 2, which was started in 2007 and completed at yearend 2008, existing data were consolidated and compiled to produce geologic maps on the mineral potential of Mauritania by region. The data were released to international mining and exploration companies. L'Unité du Cadastre Minier [Mining Cadastre Unit] managed the exploration licensing and mining rights issuance process by offering four types of licenses: reconnaissance, exploration, small-scale mining, and mining. Mineral and mineral commodities were categorized into seven groups. Group 1 included chromium, iron, manganese, titanium, and vanadium; Group 2 included more than 30 mineral commodities, such as copper, gold, and nickel; Group 3 comprised coal and other combustible fossil fuels; Group 4 was made up of the radioactive elements, such as uranium; Group 5 included most of the industrial elements, such as bauxite, limestone, and phosphate rock; Group 6 consisted of precious and semiprecious stones, except diamond; and Group 7 consisted solely of diamond (Ministry of Mines and Industry, 2008).

Commodity Review

Metals

Copper.—Mauritania's first open pit copper mine was inaugurated in 2007. The Guelb Moghrein Mine, which is located near Akjouj about 350 kilometers (km) northeast of Nouakchott, commenced commercial production in October 2006. The mine was operated by the newly established company Mauritanian Copper Mines, which was a partnership between First Quantum Minerals Ltd. of Canada (80% interest), Wadi el Rawda Industrial Investments LLC of the United Arab Emirates (19% interest), and General Gold International of Australia (1% interest). First Quantum produced 33,073 metric tons (t) of copper in concentrate in 2008, which was an increase from the 31,956 t produced in 2007. The plant employed 863 workers, and the mine had a remaining life of 9 years.

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The company planned to increase copper production to 38,000 t in 2009 by increasing the plant's production capacity to 3.8 million metric tons per year (Mt/yr) from 3.2 Mt/yr in 2008 and 2.3 Mt/yr in 2007. The expansion, which was expected to be completed in the third quarter of 2009, would allow for the processing of lower grade ore, which would increase the reserves at the mine. The 2008 yearend estimates of copper reserves at the Guelb Moghrein Mine were 19 million metric tons (Mt) of proven reserves and 11 Mt of probable reserves with a cutoff grade of 0.65% copper (First Quantum Minerals Ltd., 2009, p. 5, 8, 32).

Gold.—Red Back Mining Inc. of Canada acquired the Tasiast gold mine from Lundin Mining Corp. of Canada in August 2007 at a total cost of $278 million. Earlier that year, Lundin Mining had acquired Rio Narcea Gold Mines Ltd. With this acquisition, Red Back's holdings in Mauritania comprised three permits that cover 16,222 square kilometers (km^2), including the Ahmeyim-Tijirit, the Karet, and the Tasiast permits. The Tasiast gold mine, which was 100% owned by Red Back, was officially inaugurated on July 18, 2007. Tasiast produced 4,070 kilograms (kg) of gold in 2007 and 4,342 kg of gold in 2008 and was expected to produce 7,360 kg of gold in 2009 (Red Back Mining Inc., 2009). Estimates of ore reserves at the Tasiast were upgraded to more than 31,100 kg (1 million troy ounces) of gold from the 27,435 kg (885,000 troy ounces) that was previously reported. The yearly output of the mine was expected to be 3 Mt during the 11 years of mine life (North Africa Times, 2007). As of December 2008, the total proven ore reserves of the Tasiast gold mine were reported to be 27.2 Mt at a grade of 1.48 grams per metric ton (g/t) gold; probable reserves were 21.1 Mt at a grade of 1.46 g/t gold; and stockpile reserves were 1.7 Mt at a grade of 0.89 g/t gold (Stuart, 2009, p. 11).

First Quantum continued producing gold at the Guelb Moghrein Mine. In 2008, First Quantum sold 1,912 kg of gold, which was slightly less than the 1,916 kg provided in 2007. The company expected to increase gold production at the Guelb Moghrein Mine to 3,200 kg in 2009 (First Quantum Minerals Ltd., 2009, p. 5, 8, 32).

Iron Ore.—Qatar Steel Corp., which had previously confirmed its intention to acquire up to 49.9% interest in the $2.2 billion Guelb el Aouj iron ore project in northern Mauritania in 2007, announced in August 2008 that it was abandoning its plan to acquire an interest in the project owing to unresolved differences concerning the terms and conditions of the investment agreement with Société Nationale Industrielle et Minière S.A. (SNIM) and Sphere Investments Ltd. of Australia. Qatar Steel was the second company after Saudi Basic Industries Corp. (SABIC) to opt out of the project. The pullout of Qatar Steel came shortly after the military coup in Mauritania, but the coup was not reported as being a significant factor in the decision (Gulf News, 2008; Mining Weekly, 2008).

The Guelb El Aouj definitive feasibility study conducted by Sphere between 2006 and 2008 was completed and reportedly demonstrated the quality of the iron ore at the Guelb El Aouj deposit and the viability of developing a 7-Mt/yr direct-reduction iron ore pellet plant. On April 28, 2008, the mining license, which extends for 30 years and covers a 520-km^2 area, was issued to El Aouj Mining Co. S.A., which was a 50-50 joint venture of SNIM and Sphere.

Sphere continued exploration and drilling using two diamond drill rigs at the Lebtheinia iron ore project located east of the country's iron ore port at Noundhibou and 48 km south of the iron ore railway that was operated by SNIM. The drilling program was completed by yearend 2008. Sphere had set a target for its exploration at the portion of the mine known as Libtheinia Center of 2.0 to 2.3 billion metric tons (Gt) of in situ magnitude banded iron formation (BIF) mineralization grading from 32% to 33% iron. Sphere estimated that iron ore deposits at Libtheinia Center, Libtheinia East, and Libtheinia South would supply enough iron for a 30-Mt/yr-capacity blast furnace pellet plant (Sphere Investments Ltd., 2008).

In January, ArcelorMittal of Luxembourg and SNIM concluded a memorandum of understanding to develop iron ore resources in the El Agareb iron ore deposit located northeast of the Zouerate mining province of Mauritania, which had more than 1 Gt of high-grade magnetite iron. ArcelorMittal could increase its stake in the project to 70% from 30% after the exploration and prospecting phase is completed and could produce 25 Mt/yr of iron ore from this project if the outcome of the feasibility study supports such a target (ArcelorMittal, 2008).

Industrial Minerals

Cement.—The production capacity of the two cement producers in Mauritania—Ciment de Mauritanie and Mauritano-Française des Ciments S.A—was 850,000 t/yr, and the actual production had been about 38% of the capacity with the exception of 2007, when it reached 48%. The local cement consumption of 250,000 metric tons per year (t/yr), which averaged 75 kilograms per capita, was considered weak when compared with that of neighboring countries. Excess cement could be exported to Mali, but the lack of good transportation routes was an obstacle that would need to be overcome before additional material could be exported (Arab Union for Cement and Building Materials, 2009).

Mineral Fuels and Related Materials

Petroleum.—Mauritania produced 11.2 million barrels (Mbbl) of crude petroleum in 2006. However, the quantity was decreased to 5.5 Mbbl in 2007 and to 4.4 Mbbl in 2008. In 2007, Petroliam Nasional Berhad (Petronas) of Malaysia acquired Woodside Mauritania Pty Ltd. and WEL Mauritania B.V., which included the Chinguetti oilfield, at a cost of $418 million. In 2008, Petronas and its partners (ROC OIL Ltd. of Australia and Tullow Oil plc of the United Kingdom) reported an oil and gas discovery in the Banda offshore field, which is located northwest of Mauritania. The Government and Baraka Petroleum Ltd. of Australia signed a memorandum of understanding to construct an oil and gas pipeline system in the country to speed up the development of Mauritania's gas and oil reserves (Alexander's Gas & Oil Connections, 2008; Tullow Oil plc, 2009, p. 7).

Uranium.—In 2008, several companies prospected for uranium and conducted exploration activities in Mauritania.

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Forte Energy NL of Australia, which changed its name from Murchison United N.L. in November, had nine permits to explore for uranium in an area that covers 11,895 km^2. The results of the drilling that was conducted at the Bir En Nar area in the Zednes region indicated several high-grade uranium intersections, including four holes with intercepts of greater than 5,000 parts per million (ppm) eU_3O_8 (Murchison United NL, 2008).

Mauritania Ventures Ltd., which was a subsidiary of Alba Mineral Resources p.l.c. of the United Kingdom, was granted two more uranium exploration permits in northern Mauritania. The company collected airborne and remote sensing geophysical data to identify primary uranium targets; conducted ground-based exploration in February; performed laboratory analysis at French and Irish laboratories; identified a uranium-bearing mineral from the tyuyamunite group; and concluded the presence of uranium mineralization at Dahmane (0.092% U_3O_8), Moutal (0.0262% U_3O_8), and T75W (0.019% U_3O_8) (Alba Mineral Resources p.l.c., 2008).

Aura Energy Ltd. of Australia was awarded three uranium exploration areas. GCM Resources p.l.c. of the United Kingdom bought 13% of Aura Energy, and the two companies formed Aura-GCM Africa Alliance. In December 2008, the Aura-GCM Africa Alliance conducted ground-based radiometric surveying across eight target areas at its Oued el Foule Est exploration permit located in the north of the country to determine the scope of uranium mineralization. Uranium mineralization was confirmed up to 2,217 ppm U_3O_8. The Aura-GCM Africa Alliance planned to perform similar followup sampling on the other two licenses that it held in Mauritania (GCM Resources p.l.c., 2008, p. 5; Aura Energy Ltd., 2009).

Shield Mining Ltd. of Australia was awarded 10 exploration licenses for mineral exploration (all minerals, including uranium) in Tijirt near the Tasiast gold mine; in Akjoujt, which is located near the Guelb Moghrein Mine; in Saboussiri, which is located in the south of Mauritania; and in Conchita Florence, which is located in the north of Mauritania (Shield Mining Ltd. 2009, p. 4)

Outlook

The short-term future of Mauritania's mineral industry looked brighter by yearend 2008 because the coup had little or no effect on the country's mineral industry activity. Despite the 20% reduction in production in 2008, the hydrocarbon sector is expected to revive in the upcoming years as evidenced by the interest of international investors in the exploration for gas and oil in both offshore and onshore blocks in Mauritania. The prospects of increasing the output of iron ore in Mauritania remain high given the vast hematite and magnetite reserves present in several parts of the country. Copper and gold production is expected to increase upon the completion of expansion projects. Uranium production could commence in the near future.

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TABLE 1
MAURITANIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Copper in concentrate		--	--	5,031	31,956 r	33,073
Gold	kilograms	--	--	322 r	2,251 r	6,254
Iron ore:						
Gross weight	thousand metric tons	10,505	11,133	10,658 r	11,817 r	10,950
Iron content e	do.	6,900	7,000	6,928 3	7,680	7,120
Steel, crude	do.	5,000	1,263	1,065 r	974 r	1,598
INDUSTRIAL MINERALS						
Cement		300,000	300,000	273,963 r	409,513	322,419
Gypsum		38,940	43,266	45,222	49,229	44,428
Salt		20 e	20 e	310	420	570
MINERAL FUELS AND RELATED MATERIALS						
Petroleum, crude	thousand 42-gallon barrels	--	--	11,168	5,517 r	4,422

eEstimated; estimated data are rounded to no more than three significant digits. rRevised. do. Ditto. -- Zero.

[1]Table includes data available through August 31, 2009.

[2]In addition to the commodities listed, modest quantities of crude construction materials (clays, sand and gravel, and stone) presumably were produced, but output was not reported quantitatively. The minimill of Société Arabe de Fer et d'Acier en Mauritanie produced rebar and wire, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

TABLE 2
MAURITANIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Ciment de Mauritanie (Private Mauritanian investors, 90%, and Compañía Valenciana de Cementos, 10%)	Nouakchott	400.
Do.		Mauritano-Française des Ciments S.A.	do.	450.
Copper		Mauritanian Copper Mines (First Quantum Minerals Ltd., 80%; Wadi el Rawda Industrial Investments LLC, 19%; General Gold International, 1%)	Guelb Moghrein copper-gold mine, 350 kilometers northeast Nouakchott	380.
Gold	kilograms	First Quantum Minerals Ltd., 80%, and Guelb Moghrein Mines d'Akjoujt S.A, 20%	do.	2,200.
Do.	do.	Red Back Mining Inc., 100%	Tasiast, 300 kilometers north of Nouakchott	7,300.
Gypsum		Société Arabe des Industries Métallurgiques Mauritano-Koweitiennes (SAMIA)	Sebkha N'dramcha, between Nouakchott and Akjoujt	50.
Iron ore		Société Nationale Industrielle et Minière (SNIM) (Government, 78.4%; Industrial Bank of Kuwait K.S.C, 7.2%; Arab Mining Co., 5.7%; Iraq Foreign Development Fund, 4.6%; National Office for Carbohydrates and Minerals, 2.3%; Islamic Development Bank, 1.7%)	Guelb El Rhein, Kedia d'Idjill, and M'Haoudat Mines, Tris Zemmour	12,000.
Do.		El Aouj Mining Co. S.A. [Sphere Investments Ltd., 50%, and Société Nationale Industrielle et Minière (SNIM), 50%]	Guelb el Aouj Mine, Zouerate	17,000 ore; 7,000 direct-reduced iron.[1]
Petroleum, crude	thousand 42-gallon barrels	Petroliam Nasional Berhad (Petronas)	Chinguetti oilfield, 80 kilometers offshore	5,000.
Salt	metric tons	Société Mauritanienne des Industries du Sel (SOMISEL)	Sabkha de N'terert and d'Idjill brine pits, in the southwestern part of the country	500.

Do, do. Ditto.

[1]Under development. First production expected during the second half of 2010.

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The Mineral Industries of Morocco and Western Sahara

By Harold R. Newman

MOROCCO

The mineral industry of Morocco was dominated by phosphate production. Morocco was the world's third ranked producer of phosphate after China and the United States. The country produced 6% of the world's production of barite, 2% of the world's production of cobalt, 1.5% of the world's production of fluorspar, 1% of the world's production of lead, and 17% of the world's production of phosphate rock and was a leading exporter of phosphate rock, phosphate derivatives, and phosphoric acid (Mbendi Information Services (Pty) Ltd., 2008; Guberman, 2009; Jasinski, 2009; Miller, 2009a, b; Shedd, 2009).

Minerals in the National Economy

Mining was significant to the Moroccan economy. The country was home to more than 90 mining companies that produced 20 different minerals. The mineral industry was Morocco's leading foreign exchange earning sector and accounted for about 35% of foreign trade and 6% of the gross domestic product. Morocco hosts several world-class deposits, including Bou Azzer, which was the world's only deposit where cobalt was mined as a primary product, and Imiter, which was a world-class silver deposit. The Office Chérifien des Phosphates, (OCP) phosphate deposits contained more than 30% of the world's total phosphate reserves. In 2008, the falling prices of mineral commodities led to reduced output in the Moroccan mining sector. The Government was considering reforming its tax structure and reducing trade bureaucracy to encourage growth in its mineral industry (Market Research, 2009).

Government Policies and Programs

The Government agency responsible for oversight of the mining industry was the Ministère de l'Industrie, du Commerce, de l'Énergie et des Mines (Ministry of Industry, Trade, Energy, and Mines). The Bureau de Recherches et de Participations Minières [Office of Research and Mining Participations] (BRPM) was responsible for the development of most mineral resources. La Centrale d'Achatt et de Dévelopement de la Region Minière de Tafilalet et de Figuig was responsible for promoting and supporting the interests of artisanal miners in the Figuig and the Tafilalet regions. Government policy is to open up the mining sector to investments by both minor and major mining companies; however, phosphate production remained a state monopoly. The OCP was responsible for managing and controlling all aspects of phosphate mining and beneficiation. Mining legislation was based on the Mining Code Bill No. 1-73-412 of August 13, 1973, and is enforced through executive orders and the Directorate of Mines. All mineral resources are the property of the state, which issues permits and licenses for the exploration and exploitation of the resources (Business Monitor International, 2008).

Production

Morocco was one of the world's leading producers of phosphate rock. In terms of the value of production, phosphate rock was Morocco's most important mineral; phosphate rock also accounted for 95% of mining volume. In addition to phosphate rock, the country produced a wide variety of minerals, which included barite, clays, coal, cobalt, copper, fluorspar, gold, iron ore, lead, nickel, petroleum, salt, silver, talc, and zinc, among others. In 2008, according to reported data, cement, steel, and zinc production increased and lead production decreased (table 1).

Structure of the Mineral Industry

There was little change in the structure of the mineral industry in 2008. Mineral concentrate production continued to be dominated by the private sector with the exception of phosphates, which was a state monopoly. Table 2 is a list of major mineral industry facilities, including their capacities and locations.

Mineral Trade

Morocco signed a free trade agreement with the United States on June 15, 2004, which went into effect on January 1, 2006. The U.S.-Morocco Free Trade Agreement was a comprehensive free trade agreement and was expected to provide U.S. exporters with increased access to the Morocco market by eliminating tariffs on 95% of consumer and industrial goods. Morocco was the second Arab country, after Bahrain, and the first African country to have a free trade agreement with the United States (U.S. Department of State, 2008).

Morocco's exports of phosphate derivatives included 14.6 million metric tons (Mt) of phosphates, 2.4 Mt of chemicals and natural fertilizer, and 2.3 Mt of phosphoric acid. To boost exports, the OCP was developing market alliances and joint ventures with foreign downstream processors. Firms from Belgium, Germany, India, and Pakistan were involved in joint-venture projects with the OCP. Also, the OCP announced that it would open its phosphate hub to foreign investors to set up new plants and help expand the chemical and fertilizer industry. The OCP planned to invest $2.5 billion during the next 5 years to develop the phosphate derivatives export industry, which is a higher value activity than simply exporting the raw material (Economist Intelligence Unit, 2008).

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The United States was a major trading partner with Morocco. U.S. exports to Morocco were valued at about $1,436 million in 2008. This total included, in order of value, more than $146 million for coal and other fuels, $67 million for petroleum products, $27 million for iron and steel products, $20 million for fuel oil, and $19 million for steelmaking materials (U.S. Census Bureau, 2008a).

U.S. imports from Morocco were valued at about $879 million in 2008. This total included, in order of value, about $368 million for sulfur and nonmetallic minerals, $32 million for miscellaneous nonferrous metals, $16 million for other petroleum products, and $2 million in industrial inorganic chemicals and accounted for 21% of Morocco's exports (U.S. Census Bureau, 2008b).

Commodity Review

Metals

Cobalt.—Cobalt in Morocco is associated with arsenic in narrow vein structures found at the contact of a serpentine and quartz-rich diorite. The serpentines are the most obvious source rock for cobalt. The mineralized veins are vertically continuous for an estimated 200 meters (m). The ore has undergone several phases of brecciation and recrystallization related to late Pan-African and Hercynian deformations, which produced the various shapes of the ore bodies: flat lenses, lodes, stock works, and veins (Leblanc and Billaud, 1982).

Managem S.A. (a subsidiary of Omnium Nord African (ONA), which was the leading private mining company in Morocco) continued to mine cobalt ore at the Bou Azzer underground mine. Bou Azzer, which is literally translated as "where the fig tree stands," is located 35 kilometers (km) south of Ouarzazate in southern Morocco in the central Anti-Atlas Mountain range.

Managem announced that it expected to have a 2008 net loss because of the downturn in the economy and the drop in the prices of cobalt and base metals in the second half of 2008. Rising prices of such materials as sulfuric acid also affected Managem's net results. Efforts were continuing to improve management, streamline costs, and address volatility in output. The price of Managem's shares went down by 59% in 2008 (Mining Journal, 2009).

Copper.—Odyssey Resources Ltd. of Canada was the first foreign company to independently acquire exploration licenses in Morocco. Of its 25 licenses, 6 copper-silver deposits and 2 tailings dumps were 100% owned by Odyssey and 18 were acquired through lease with an option to purchase from the Government's Office National des Hydrocarbures et des Mine (ONHYM). Odyssey's main advanced project was the Alous deposit, which includes both structurally and stratigraphic hosted copper-silver mineralization. The Alous deposit is the largest deposit within the Anti-Atlas property, which covers about 500 square kilometers (km^2) and is located in southwestern Morocco. Exploration drilling continued in 2008 (Odyssey Resources Ltd., 2008).

ResidInvest S.A.R.L. is a Moroccan exploration company in the process of becoming a producing mining company. ResidInvest acquired exploration licenses for the Tazoughert copper deposit in the Province of Er Rachidia in southeastern Morocco. Drilling at Tazoughert resulted in the discovery of a large hydrated copper carbonate deposit with a grade ranging from 7% to 21% copper at a depth of 6 m. ResidInvest estimated possible copper ore resources to be about 40 Mt. The group of licenses is located about 35 km northwest of Boudnib in the southern edge of the High Eastern Atlas (ResidInvest S.A.R.L., 2008).

Gold.—Odyssey also owned the Talouine gold deposit, which is located in the southern Anti-Atlas Mountains west of and on strike with the Taferent gold deposit, which was owned by the ONHYM. Taferent hosted an estimated resource of 5.6 Mt of ore at an average grade of 1.22 grams per metric ton (g/t) gold. The Taferent property consists of three exploration licenses that cover an area of 48 km^2; the deposit is hosted in Precambrian volcanic and intrusive rocks. Odyssey was also investigating the Tizintfirst gold property, which hosts a gold-bearing gossan. The 16-km exploration license is located in the eastern Anti-Atlas Mountains (Van der Merwe, 2008).

Kasbah Resources Ltd. of Australia's Tamlalt gold deposit consists of eight exploration permits that cover a surface area of 128 km^2. Ground magnetic surveying had defined 2,000 m of potential host rocks under shallow cover to the southwest of the Jebel Malek gold prospect and identified two discreet magnetic anomalies. Based on the results of the surveys, new drill targets were defined at Tamlalt and work was scheduled to continue into 2009 (ABN Newswire, 2008b).

Lead.—Emerging Capital Partners of the United States and Truffle Capital of France jointly acquired a 100% stake in Compagnie Minière de Touissit (CMT) for $53 million. CMT, which was the oldest lead producer in Morocco, specialized in the exploration, extraction, and treatment of lead and zinc. CMT owned mines and an ore treatment plant at Tighza, southeast of Meknes (Paydirt, 2008).

Silver.—Silver in Morocco occurs both as the principal metal in ore deposits at Igoudrane and Imiter and as a byproduct of copper, lead, and zinc mining operations. Most of the country's silver production came from the Imiter Mine, which was owned and operated by Société Metallurgique d'Imiter (SMI) (a subsidiary of Managem S.A.). The Imiter Mine is located about 25 km from Boumaine du Dades in the Oriental Anti-Atlas Mountains in central Morocco. The mountains have a Precambrian basement and a cover of Paleozoic rocks. The volcano-sedimentary bedrock is favorable to polymetallic mineralization, such as that of the Imiter silver deposit and the Bou Azzer cobalt deposit. After phosphates, silver was Morocco's second most significant mineral product (MinVision, 2008).

Tin.—Kasbah Resources acquired the rights to two tin deposits; one (the Achmmach Mine) was an advanced, large, hard rock project, and the other (the El Karit Mine) was a historic, hard rock open pit mine that the company had been evaluating. The Achmmach Mine, which was the larger of the two projects, was considered to be a significant tin deposit. At Achmmach, a total of 17 diamond drill core holes totaling 4,192 m were drilled with the twin objectives of investigating the previous drilling undertaken by BRPM and testing the

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potential for shallow zones of tin mineralization in the Eastern area. The phase 1 drilling program was completed in 2008 with the testing of 650 m of a 2-km-long mineralized system. Drilling discovered new shallow tin zones in the eastern area. Phase 2 drilling was commenced with the aim of expanding the proven mineralization beyond the existing underground workings in the western area of the Achmmach project. Achmmach was estimated to have a resource of about 1 Mt of ore at a grade of 1% tin (ABN Newswire, 2008a).

Industrial Minerals

Cement.—The Moroccan cement industry comprised the following four companies: Asment de Temara; Holcim (Maroc) S.A.; Lafarge S.A. (Lafarge), through Lafarge Ciments (Maroc), which was a 50% owned subsidiary of the Lafarge Group of France; and Société les Ciments du Maroc S.A.

Diamond.—Metalex Ventures Ltd. of Canada's exploration project covered an area of 24,804 km^2 of Archaean and Proterozic rocks that have never been systematically explored for diamond. Following an agreement with ONHYM, 904 drainage and loam samples were collected across an area of 13,509 km^2 and diamond indicator minerals were found in 16 of the samples. Metalex planned to focus on back tracking the positive results to their sources. Also, Metalex planned to conduct a base-metal, diamond, and gold reconnaissance exploration program in an 11,295-km^2 area underlain by an unexplored Archean craton (Metalex Ventures Ltd., 2008).

Phosphate Rock.—Phosphate rock is found mainly in the western part of Morocco. Morocco's estimated phosphate reserves were 85,000 Mt, which was the largest share of the world's known phosphate reserves. The OCP was the country's sole producer of phosphate rock, most of which was exported. The OCP planned to invest about $12 billion during the next 7 to 8 years to expand its output and world market share. The OCP stated that it had 49% of the world phosphoric acid market, 45.5% of the world phosphate market, and 12% of the world fertilizer market. In 2008, the OCP was the leading world phosphate exporter (Miningreview.com, 2008).

The Libya-Africa Investment Portfolio of Switzerland and the OCP signed an agreement to jointly develop ammonia, phosphoric acid, and diammonium phosphate (DAP) fertilizer plants in Morocco and Libya. Under the $1 billion agreement, the two firms would construct a 1-million-metric-ton-per-year (Mt/yr) phosphoric acid plant at Jorf Lasfar in Morocco at a cost of $350 million; an 800,000-t/yr ammonia plant in Libya at a cost of $500 million; and a $150 million DAP facility in either Libya or Morocco. The Government was encouraging investment in the domestic fertilizer section and, in 2008, signed a similar $600 million agreement with PetroVietnam Fertilizer and Chemicals Co. to build a DAP plant (James, 2008)

Mineral Fuels, Related Materials, and Other Sources of Energy

Morocco imports 96% of its energy requirements and was North Africa's leading importer of petroleum and natural gas. Morocco's economy was affected by the surge in global oil prices. The energy cost was $1.1 billion in the first quarter of 2008, which was a 69% increase compared with the same period in 2007 (Morocco Newsline, 2008).

The potential for hydrocarbon resources was thought to exist in large, yet-to-be-explored areas of Morocco. The Government reported that it would use a fourfold strategy to explore for petroleum in different parts of the country. The strategy included boosting the promotion of sedimentary basins, developing partnerships, using new technology for exploration, and exploiting data relating to sedimentary basins. Onshore and offshore sedimentary basins were not well explored compared with other countries. In 2008, only four exploration wells in a 10,000-km^2 area had been drilled in Morocco, whereas the international average was 800 wells for a 10,000 km^2 area. (Xinhua News Agency, 2008).

Coal.—The power utility l'Office National de l'Électricite (ONE) reported that it would initiate a major independent power project (IPP) at Safi, which is located halfway between Agadir and Casablanca on the west coast. The coal-fired thermal powerplant would have a capacity of about 1,320 megawatts (MW) and would be the second IPP after Jorf Lasfar. In 2008, Morocco had an installed capacity of 5,292 MW. When it comes onstream in 2012, the plant was expected to produce 27% of Morocco's annual energy requirement, which was increasing at a rate of 8.3% per year. The project had an estimated cost of $2.7 billion and would include clean-coal technology to help reduce the facility's carbon dioxide emissions (Middle East Economic Digest, 2008c).

Natural Gas.—Circle Oil plc of the United Kingdom announced that it had made a third gas discovery after it had drilled and tested the KSR-8 well northeast of Rabat in the Sebou permit of the Rharb Basin. Circle reported that the KSR-8 well had been tested in two zones and that it flowed under test at one of the highest flow rates ever in the Rharb Basin. The lower of the two zones in the Main Hoot formation showed a sustained gas flow rate of 12.5 million cubic feet per day, and the Upper Hoot zone had a reported sustained flow rate of 6.8 million cubic feet per day. Circle Oil held permits in the Oulad N'Zala and the Sebou areas where it had targeted about 100 sites for exploration. Circle Oil held the concession agreement with the ONHYM, which had a 25% interest (Labanyi, 2009).

Petroleum.—International Petroleum Investment Company (Ipic) of Abu Dhabi approved plans to build a refinery at Jorf Lasfar on Morocco's west coast. The refinery was expected to have a capacity of 200,000 barrels per day (bbl/d) and cost about $5 billion. It would provide refined products for the local market. The source of the crude oil was expected to be Abu Dhabi. The refinery was scheduled for commissioning in 2013. Morocco's refinery at Mohammedia was operated by Société Anonyme Marocain de l'Industrie du Raffinage (Samir). The 126,000-bbl/d refinery was being upgraded after a fire caused damage to the infrastructure (Middle East Economic Digest, 2008a).

Xtract Energy plc of the United Kingdom announced the signing of a joint-venture agreement with Alraed Ltd. Investments Holdings Co. of Saudi Arabia. The joint-venture company, Xtract Energy (Oil Shale) Morocco SA, was established to evaluate and develop oil shale projects in Morocco. Xtract Energy (Oil Shale) Morocco signed a memorandum of understanding with the ONHYM to evaluate

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the possible development of an oil shale deposit near Tarfaya in southwestern Morocco (London Stock Exchange plc, 2008).

Renewable Energy.—The Government of Spain granted the Government of Morocco a $5 million loan to fund the construction up of 1,215 photovoltaic solar systems in the central Provinces of Bengurir and Errachdia. The project was part of the solar energy program named "Chourouk," which was aimed at promoting rural electrification. The program provides for installation of 200,000 systems nationwide (Maghreb Arabe Presse, 2008).

Prequalified companies were invited to submit proposals for the 300-MW Tarfaya wind farm. The estimated $500 million project covers the development, financing, design, engineering, procurement, construction, commissioning, operation, and maintenance of the farm. A total of 16 companies were prequalified. The Government planned to develop 1,000 MW of wind power capacity by 2012 (Middle East Economic Digest, 2008b).

Uranium.—The ONHYM was encouraging exploration for uranium. Morocco's several uranium mineralization settings included paleochannel-type occurrences, granites with vein-type occurrences, and occurrences in sedimentary and metamorphic terrains. More than 100 uranium occurrences have been identified within Morocco. Toro Energy Ltd. of Australia signed a memorandum of understanding with the ONHYM granting it exclusive rights for 6 months to review the potential of selected prospects in three main areas that included Haute Moulouya-Ment, the Sirwa (Zgounder), and the Wafaga. If a strong potential for likely uranium deposits is identified, Toro has exclusive rights to negotiate and enter into joint-venture agreements with the ONHYM (Mining Weekly Online, 2008).

Outlook

The Government is expected to continue to establish joint ventures with international companies, particularly in the energy sector. Also, Government policies could encourage increased mining sector investments by both minor and major mining companies. The Government is expected to take steps to privatize selected state-owned mining assets and launch reform programs within the mining sector to boost its competitiveness. Morocco intends to become a regional investment and trade platform between Europe, the countries of Southern Europe and Sub-Sahara Africa, and the United States and plans to invest heavily in infrastructure in the near future to accomplish this goal. The OCP is expected to start to encourage foreign investment in the phosphate sector, and the phosphate industry will likely continue to dominate Morocco's mineral sector for the next 6 to 8 years.

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WESTERN SAHARA

The issue of sovereignty for Western Sahara remained unresolved in 2008. The territory, a desert area bordering the Atlantic Ocean between Mauritania and Morocco, was contested by Morocco and the Popular Front for the Liberation of the Saguia el Hamra and Rio de Oro (Polisario), an independence movement based in Tindouf, Algeria. Western Sahara's economy was dependent on pastoral nomadism, fishing, and phosphate mining.

Interest in oil exploration contracts in areas offshore Western Sahara increased during 2008. In late 2007, the Saharawi Arab Democratic Republic (SADR) had launched a second natural gas and petroleum round for nine blocks in the Western Sahara region even though the political status of the territory, which was contested by Morocco and SADR, remained unresolved. Most of the blocks lie in the relatively unexplored Mesozoic and Tertiary Aaiun Basin. The following six offshore blocks with water depths ranging up to 3,600 m were on offer beginning in 2008: Tah (20,892 km^2); Zug (20,476 km^2); Jreifia (17,361 km^2); Farsia (17,318 km^2); Imlili (16,965 km^2); and Amgala (15,417 km^2). The onshore blocks on offer were Umdreiga (39,603 kkm^2); Smara (29,895 km^2); and Tichla (14,579 km^2). During the year, SADR extended the closing date of the second licensing offering to March 31, 2009, owing to the global financial crisis and reduced oil prices. Contracts were not expected to come into force until the political status of the area is resolved (Middle East Economic Digest, 2007; SADR Petroleum Authority, 2008).

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TABLE 1
MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
METALS						
Antimony, sodium antimonate		500	500	500	500 [e]	500
Cobalt:						
Concentrates, gross weight		18,410	13,030	13,000	13,000 [e]	13,000
Co content		1,600	1,100	1,100	1,100 [e]	1,000
Metal[3]		1,594	1,613	1,405	1,591	1,711 [4]
Copper:						
Concentrates, gross weight		10,308	12,654	17,811	19,900	20,000
Cu content, concentrates		4,400 [r]	3,800	4,600	5,572 [r]	5,600
Gold	kilograms	1,493	1,786	1,800	1,600 [e]	1,600
Iron and steel:						
Iron ore:						
Gross weight		9,900	8,130	8,818 [r]	9,000 [r]	9,000
Fe content		5,300 [e]	4,228	4,585 [r]	4,680 [r]	4,680
Metal:						
Pig iron[e]		15,000	15,000	15,000	15,000	15,000
Steel, crude		5,000 [e]	205,000	314,000	325,000 [e]	478,000 [4]
Lead:						
Concentrate:						
Gross weight		58,810	59,920	59,107	60,000 [e]	48,000
Pb content		41,400	42,200	41,370	44,800	33,500
Cupreous matte, Pb content[e]		600	600	600	600	600
Metal:						
Smelter, primary only		40,712	54,460	55,000	55,000 [e]	50,000
Refined:						
Primary		35,000	38,600	44,700	44,700 [e]	42,900
Secondary[e]		4,000 [4]	4,000	3,000	3,000	3,000
Total[e]		39,000	42,600	47,700	47,700	45,900
Manganese ore, largely chemical-grade		9,050	11,267	4,815	4,160	4,000
Mercury[e]		10	10	10	10	10
Nickel content of nickle sulfate		130	99	80	80 [e]	80
Silver:						
Ag content of concentrates	kilograms	25,952	26,000	50,700	51,000	50,000
Ag content of matte and smelter bullion[e]	do.	170,000	170,000	195,000	186,000 [r]	180,000
Total	do.	195,952	196,000	245,700	237,000 [r]	230,000
Zinc concentrate:						
Gross weight		146,200	151,270	148,690	111,100	186,000
Zn content		72,363	78,660	77,320	57,770 [r]	96,900
INDUSTRIAL MINERALS						
Arsenic trioxide		6,866	8,939	8,950	8,000 [e]	8,000
Barite, crude		313,000	325,222	454,738	664,700 [r]	660,000
Cement, hydraulic	thousand metric tons	7,972 [r]	10,284 [r]	11,352 [r]	12,792 [r]	14,047 [4]
Clays, crude:						
Bentonite		85,400	64,350	65,000	137,100 [r]	135,000
Fuller's earth (smectite)		28,700	29,060	29,400 [r]	121,700 [r]	120,000
Montmorillonite (ghassoul)		1,240	1,010	1,000	1,000 [e]	1,000
Feldspar		30,270	27,795	28,000	28,000 [e]	28,000
Fertilizers[e]	thousand metric tons	2,405 [4]	2,400	2,400	2,400	2,400
Fluorspar, acid-grade		112,100	114,740	94,254	78,900	80,000
Gypsum[e]		600,000	600,000	600,000	600,000	600,000
Phosphate rock:						
Gross weight[5]	thousand metric tons	25,568	28,119	27,244	27,000 [e]	25,000
P_2O_5 content	do.	8,507	9,195	8,718	8,700 [e]	8,000
Phosphoric acid	do.	3,254	3,392	3,045	3,000 [e]	2,800

See footnotes at end of table.

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TABLE 1—Continued

MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
INDUSTRIAL MINERALS—Continued						
Salt:[5]						
Rock		253,800	283,896	301,061	215,800 [r]	225,000
Marine[e]		36,000	36,000	16,234 [4]	16,000	16,000
Total		289,800	319,896	317,295 [r]	231,800 [r]	241,000
Strontium minerals, celestite[e]		2,700	2,700	2,700	2,600	2,600
Sulphuric acid[e]		9,500	9,500	9,500	9,500	9,500
Talc and pyrophyllite		255	--	--	--	--
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:[e]						
Gross	million cubic meters	40	40	40	42	42
Dry	do.	35	35	35	36	36
Petroleum:						
Crude	thousand 42-gallon barrels	246	245	240	245 [e]	250
Refinery products:						
Liquefied petroleum gas[e]	do.	2,500	2,435 [4]	2,500	2,500	2,500
Gasoline	do.	2,183 [r]	3,172	3,172 [r]	3,104 [r]	3,434 [4]
Jet fuel	do.	1,393 [r]	2,095	1,886 [r]	2,339 [r]	2,096 [4]
Kerosene	do.	90 [r]	14 [r]	22 [r]	-- [r]	-- [4]
Distillate fuel oil	do.	16,815 [r]	17,129 [r]	16,815 [r]	14,890 [r]	13,570 [4]
Residual fuel oil	do.	15,076 [r]	15,345	15,083 [r]	15,112 [r]	16,000
Other	do.	1,000	1,909	1,000 [e]	1,000 [e]	1,000
Total	do.	39,057 [r]	42,099 [r]	40,478 [r]	38,945 [r]	38,600

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through July 31, 2009.

[2]In addition to the commodities listed, perlite and a variety of crude construction materials are produced, but information is inadequate to make estimates of output levels.

[3]Cobalt electrowon from cobalt concentrates and tailings from the Bou Azzer Mine.

[4]Reported figure.

[5]May include production from Western Sahara.

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TABLE 2
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO			
Arsenic trioxide	Compagnie de Tifnout Tiranimine (CTT) (Managem S.A., 55.2%, and Société Metallurgique d'Imiter, 20%)	Guemassa, Marrakech	6,100
Barite	Central d'Achat et de Développement de la Région Minière du Tafilalet et de Figuig (CADETAF) (artisanal miners)	Errachidia, Figuig, and Ouarzazate	16,000
Do.	Compagnie Marocaine des Barytes (COMABAR) [Norbar Minerals AS, 55%, and Bureau de Recherches et de Participations Minières (BRPM), 45%]	Tlet Ighoud, Safi	160,000
Do.	do.	Zelmou, Figuig	110,000
Do.	Morocco Minerals Co.	Chemaia, Safi	NA
Do.	Ouiselsat Mines S.A.	Tazzarine, Ouarzazate	NA
Do.	Société de Commerialisation et d'Exploitation Miniere d'Imoulasse (SCEMI)	NA	NA
Do.	Société Commerciale et Miniere du Sahara (SOCOMIS)	Tichka	NA
Do.	Société de Recherches et d'Exploitation Minieres Nadia	Tinitine, Marrakech	NA
Do.	Société Industrie Miniere Marocaine (IMM)	Tichka, Marrakech	NA
Do.	Société Miniere des Barytines d'Asni (SMBA)	NA	NA
Do.	Société Nord Africaine de Recherches et d'Exploitation des Mines d'Argana (SNAREMA)	Seksaoua, Marakech	120,000
Do.	Société Nouvelle Union des Metaux Maroc (SNUMM)	Jbel Abdellah, Errachidia	12,000
Do.	Société Zenaga	Tinjdad, Errachidia	NA
Barite, chemical grade	Société Nord Africaine de Recherches et d'Exploitation des Mines d'Argana (SNAREMA)	Argana	30,000
Bentonite	Société Miniere Bentonite d'Afarha S.A. [Grupo Tolsa of Spain, 80%, and Bureau de Recherches de Participations Minières (BRPM), 20%]	Aferha	9,200
Do.	Société d'Exploitation des Mines du Rif (SEFERIF) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Bou Hoed, near Ouixane	15,000
Do.	Compagnie Marocaine des Barytes (COMABAR) [Norbar Minerals AS, 55%, and Bureau de Recherches de Participations Minières (BRPM), 45%]	Azzouzet-Tidiennit	5,000
Do.	North African Industrial Minerals Exploration S.A.R.L. (S&B Group)	Trebia Mine	NA
Celestite	Société Karia Mines	Jbel Kifane, Taounate	NA
Cement, portland	Asment de Temara (Cimentos de Portugal, 57.4%)	Kiln and mill at Temara	845,000
Do.	Société Lafarge Ciments S.A. (Lafarge Maroc, 69.2%; general public, 12.23%; Caisse de Dépôt et de Gestion, 8.25%; Islamic Development Bank, 5.46%)	Douar Laaouameur kiln and mill south of Casablanca	2,000,000
Do.	do.	Cadem clinker mill at Meknes	1,000,000
Do.	do.	Tamuda kiln and mill, Tetouan	800,000
Do.	do.	Kiln and mill at Tangier	250,000
Do.	do.	Tetouan II kiln and mill	(1)
Do.	Société Holcim (Maroc) S.A. (Holcim Ltd. of Switzerland, 51%; general public, 35.2%; Islamic Development Bank, 13.8%)	Kiln and mill at Oujda	1,000,000
Do.	do.	Settat kiln and mill	1,700,000
Do.	do.	Fes, Ras El Ma kiln and mill	1,200,000
Do.	do.	Fes, Doukkarat clinker mill	600,000
Do.	do.	Nador clinker mill	400,000
Do.	Société les Ciments du Maroc S.A. (CIMAR) (Ciments Français S.A., 58.3%; general public 8.97%; Caisse Interprofessionnelle Marocaine des Retraites, 7.78%; Banque Nationale pour le Developpement Economique, 5.65%; Fonds d'Abu Dhabi pour le Développement Economique Arabe, 5.38%)	Kiln and mill at Agadir	1,220,000
Do.	do.	Kiln and mill at Marrakech	1,300,000
Do.	do.	Kiln and mill at Safi	850,000
Do.	do.	Laâyoune clinker mill	350,000
Clay	Société du Ghassoul et de ses Derives SEFRIOUI SA	Tamdafelt	NA
Do.	Antonio Reyes Mine	Haddou Ammar, Nador	NA

See footnotes at end of table.

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TABLE 2—Continued
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO—Continued			
Coal, anthracite	Charbonnages du Maroc [Bureau de Recherches de Participations Minières (BRPM), 98.89%]	Jerada	650,000
Cobalt:			
Ore, gross weight	Compagnie de Tifnout Tiranimine (CTT) (Managem S.A., 55.2%, and Société Metallurgique d'Imiter, 20%)	Bou Azzer, Ouarzazate	17,000
Metal	do.	Guemassa, Marrakech	1,400
Copper, concentrate	Société Minière de Bou Gaffer (SOMIFER) [Bureau de Recherches de Participations Minières (BRPM), 34.2%; Société Metallurgique d'Imiter, 36%; Managem S.A., 7.6%]	Bleida	50,000
Do.	Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa, Marrakech	18,000
Do.	Société de Développement du Cuivre de l'Anti-Atlas (SODECAT) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Tiouit	4,500
Fluorspar, concentrate	Société Anonyme d'Entreprises Minières (SAMINE) (Managem S.A., 58%, and Société Metallurgique d'Imiter, 42%)	El Hammam, Khémisset	120,000
Gold	Akka Gold Mining Co. [Managem S.A., 70%, and Bureau de Recherches de Participations Minières (BRPM), 16.07%]	Iourim, Tiznit	3
Liquefied petroleum gas million metric tons	Société d'Exploitation des Mines du Rif (SEFERIF) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Bouhoua, Nador	12
Lead:			
Concentrate	Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa	29,900
Do.	Compagnie Minière de Touissit (CMT) (Emerging Capital Partners, 50%, and Truffle Capital, 50%)	Touissit, Jerada	73,000
Metal[2]	Société des Fonderies de Plomb de Zellidja (SFPZ) (Zellidja S.A., 50.4%)	Oued El Heimer	70,000
Manganese, concentrate	Société Anonyme Chérifienne d 'Etudes Minières (SACEM) [Bureau de Recherches de Participations Minières (BRPM), 43%, and Compagnie Minière de l'Ogooué SA (COMILOG), 30%]	Imini, Ouarzazate	14,000
Perlite	Perlite Roche [Roche Investments, 70%, and Bureau de Recherches de Participations Minières (BRPM), 20%]	Tidiennit	20,000
Do.	Perlite Inc. (Roche Investments)	Expansion plant at Berrechid, near Casablanca	NA
Petroleum, refinery thousand 42-gallon barrels	Société Anonyme Marocaine de l'Industrie du Raffinage (SAMIR) (Group Corral Petroleum, 64.7%, and general public, 35.3%)	Mohammedia	47,000
Do. do.	do.	Sidi Kacem	9,500
Phosphate rock	Office Chérifien des Phosphates (OCP) (Government, 100%)	Sidi Daoui Mine, Khouribga mining center	10,000,000
Do.	do.	Mera El Arech Mine, Khouribga mining center	6,000,000
Do.	do.	Benguerir open pit mine, Gantour mining center	4,000,000
Do.	do.	Youssoufia underground mine, Gantour mining center	3,000,000
Do.	do.	Sidi Chennane Mine, Khouribga mining center	2,000,000
Phosphoric acid, P_2O_5 content	Indio Maroc Phosphore S.A. [Office Chérifien des Phosphates (OCP), 50%, and K.K. Birla Group, 50%]	Jorf Lasfar	330,000
Do.	Office Chérifien des Phosphates (OCP)	Maroc Chimie I and II, Safi	270,000
Do.	do.	Maroc Phosphore I and II, Safi	1,100,000
Do.	do.	Maroc Phosphore III and IV, Jorf Lasfar	1,400,000
Phosphoric acid (purified), P_2O_5 content	Euro-Maroc Phosphore Co. [Office Chérifien des Phosphates (OCP), 33%; Société Chimique Prayon-Rupel, 33%; Chemische Frabrik Budenheim KG, 33%)	Jorf Lasfar[3]	120,000

See footnotes at end of table.

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TABLE 2—Continued
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2008

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO—Continued			
Salt:			
Rock	Société de Sel de Mohammedia (SSM) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Aîn Tekki, Mohammedia	226,500
Marine	Société Chérifienne des Sels (SCS) [Bureau de Recherches de Participations Minières (BRPM), 50%, and Société Nouvelle des Salins du Sine Saloum (SNSSS), 50%]	Lac Zima, Safi	30,000
Silver, ore	Société Metallurgique d'Imiter (SMI) (Managem S.A., 75.72%, and general public, 24.28%)	Near Quarzazate	525
Steel products:			
Bars and sections	Société Nationale de Sidérurgie (Sonasid) (general public, 31.14%; Société Nationale d'Ivestissement S.A., 21.07%; Axa Assurances Maroc, 8.53%; Aceralia Redendos, 8.5%)	Jorf Lasfar	300,000
Rebar and wire rod	do.	Nador	540,000
Do.	do.	Casablanca	80,000
Cold-rolled sheet	Maghreb Steel S.A.	do.	250,000
Talc and pyrophilite:			
Pyrophilite	Société Industrie Minière Marocaine (IMM)	Khenifra	NA
Talc	Société Zenaga	Tinjdad, Errachidia	NA
Do.	do.	Taliouine, Ouarzazate	NA
Zinc, concentrate	Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa	170,000
Do.	do.	Draa Sfar	(1)
Do.	Société des Mines de Tennous (SOMITE)	Aguerd N'Tazoult, Azilal	NA
Do.	Société Mineral et Substances	Lalla Mimouna, Taza	NA
WESTERN SAHARA			
Phosphate rock	Phosphates de Boucraa S.A. [Office Chérifien des Phosphates (OCP), 65%]	Open pit mine, Boucraa mining center	2,000,000

Do, do. Ditto. NA Not available.
[1]Under construction.
[2]SFPZ also refines silver and produces copper matte and sodium antimonate.
[3]A second purified phosphoric acid plant with a capacity of 120,000 metric tons per year was under construction.

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The Mineral Industry of Mozambique

By Thomas R. Yager

In 2008, Mozambique played a significant role in the world's production of aluminum, ilmenite, tantalum, and zircon. The country's share of world tantalum output amounted to about 9%; ilmenite and zircon, 2% each; and aluminum, 1%. Other domestically significant mineral processing operations included cement and natural gas. Mozambique was not a globally significant consumer of minerals or mineral fuels (Bray, 2009; Gambogi, 2009a, b).

Minerals in the National Economy

In 2006 (the latest year for which data were available), the manufacturing sector accounted for 15% of the gross domestic product, and mining and quarrying, 1.1%. The Mozambique Aluminum SARL (Mozal) smelter accounted for about one-half of manufacturing output but had a much more modest effect on employment. About 50,000 artisanal miners were estimated to be employed in the production of colored gemstones and gold. In the first 9 months of 2007, aluminum exports were $1.14 billion, or nearly 62% of national exports; natural gas exports were $85 million (Government of Mozambique, 2008, p. 31; Lehto and Goncalves, 2008, p. 310; Organisation for Economic Cooperation and Development, 2008, p. 463).

Production

In 2008, the production of gold increased by 207%; morganite, 178%; ilmenite, 134%; niobium (columbium), an estimated 100%; tantalum, an estimated 96%; crude bentonite, 76%; coal, 60%; zircon, 25%; and natural gas, 12%. Beryl output declined by 75%; diatomite, 42%; bauxite, 37%; rutile, 25%; and processed bentonite, 19%. Semimanufactured steel production restarted in 2008. Natural gas accounted for 64% of the value of production in the mineral industry excluding aluminum; titanium minerals, 17%; and tourmaline, 9% (Eduardo Alexandre, Director, National Directorate of Mines, written commun., October 27, 2009).

Structure of the Mineral Industry

Most of Mozambique's mining and mineral processing operations were privately owned, including the cement plants, the Moma mineral sands mine, the Mozal aluminum smelter, the Noventa tantalum mine, and the Temane gas processing plant. Artisanal miners produced gold and gemstones. Carbomoc E.E., which was the country's only coal producer, was state-owned.

Commodity Review

Metals

Aluminum and Bauxite.—Mozambique was Africa's second ranked producer of aluminum after South Africa. The Mozal aluminum smelter, which used alumina imported from western Australia as raw material, produced 536,000 metric tons (t) in 2008 compared with 564,000 t in 2007. Output declined because of power shortages in South Africa. The power shortages also delayed plans by BHP Billiton Ltd. of Australia to increase Mozal's capacity (table 2; BHP Billiton Ltd., 2008, p. 6; 2009, p. 6; Mining Journal, 2008b).

E.C. Meikles (Pty) Ltd. of Zimbabwe operated the Moriangane bauxite mine in Manica Province. Most of the mine's output was exported to Zimbabwe for use in the production of aluminum sulfate. In 2007, production declined at Moriangane because of power supply problems. Subsequent declines in 2008 may also be attributable to lack of consistent power supplies or the economic crisis in Zimbabwe (Government of Mozambique, 2008, p. 70; Lehto and Goncalves, 2008, p. 314).

Copper and Gold.—Agrupamento Mineiro (a joint venture of Companhia Mineira de Gile and Metais de Moçambique of Angola) produced gold at its mine in the Manica District. Agrupamento planned to produce 720 kilograms per year (kg/yr) of gold during the 10-year life of the mine. The company planned to export its output to the Rand refinery in South Africa (Machirica, 2007).

In November 2008, Delta Trading Company Lda. was granted a mining license for the Monarch Mine. The company planned to reopen Monarch in 2009. Delta spent nearly $8 million on gold exploration in 2008 and planned to spend $14 million in 2009; expenditures for 2009 were likely to include an estimate of reserves at Monarch (Africa Mining Intelligence, 2008b).

In 2008, Pan African Resources plc of the United Kingdom (Metorex Ltd. of South Africa, 55%) was engaged in a prefeasibility study of the development of a mine at the Fair Bride deposit. Resources at Fair Bride, which is located near Manica, were estimated to be 7.9 million metric tons (Mt) at a grade of 5.49 grams per metric ton gold (g/t) (Mining Journal, 2008b).

Baobab Resources plc of Australia explored at the Mundonguara copper-gold deposit; the Mundonguara Mine closed in 1989. In August 2008, Baobab announced a resource estimate of 3.1 Mt of ore at a grade of 1.4% copper, 2.1 g/t silver, and 0.11 g/t gold. The company commenced a scoping study at Mundonguara (Dixon, 2008a).

ABM Resources NL of Australia explored for copper and gold at the Mimosa project. Artisanal miners produced gold at Mimosa; ABM reached an agreement with the miners to include their tenements in the project in return for a royalty (Mining Journal, 2008b).

Iron and Steel.—In 2008, ArcelorMittal South Africa Ltd. restarted production at the Trem de Varao rolling mill in Maputo. The plant, which had a capacity of 35,000 metric tons per year (t/yr), processed billet imported from South Africa. ArcelorMittal also planned to complete a new bar and rod mill at Matola in 2009. The new plant was expected to have a capacity

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of 400,000 t/yr; estimated capital costs were $80 million. Billet was also likely to be imported from the Newcastle steel plant in South Africa. In November, the company decided to suspend production at the Maputo plant and development of the new plant at Matola until the second quarter of 2009 (Africa Mining Intelligence, 2008a; Bain, 2008).

Niobium and Tantalum.—Noventa Ltd. operated the Marropino Mine, which produced 65,196 kilograms (kg) of columbite-tantalite concentrate in 2008 compared with its target of about 91,000 kg. Production was limited by equipment problems in the processing plant, low ore grades and recovery rates, and power shortages because of delays in the delivery of grid power to the mine. By the end of 2009, Noventa planned to increase its capacity to between 205,000 and 250,000 kg/yr of tantalum pentoxide (Ta_2O_5) from 160,000 kg/yr (Noventa Ltd., 2008; 2009, p. 3-4).

Noventa also planned to reopen the Morrua Mine; production was expected to be about 225,000 kg/yr of Ta_2O_5. The reopening of Morrua depended on the availability of grid power, which was expected by the end of the first quarter of 2009, and securing capital for the project. The life of the Morrua Mine was estimated to be between 10 and 11 years, and the Marropino Mine, 6 years (Noventa Ltd., 2008; Ruffini, 2008).

Titanium and Zirconium.—Kenmare Resources plc of Ireland produced ilmenite, rutile, and zircon at the Moma Mine; the production of ilmenite amounted to 328,875 t in 2008. The company experienced problems with equipment in the first half of 2008 that limited production. In September, irregular power supplies caused the mine to shut down temporarily and damaged equipment. At the end of 2008, reserves at Moma were estimated to be 634 Mt at a grade of 3.3% ilmenite (Mining Journal, 2008a; Mozambique News Agency, 2008b; Kenmare Resources plc, 2009, p. 9-10).

Kenmare planned to increase ilmenite production to its full capacity of 800,000 t/yr by the end of 2009; the output of zircon would be 56,000 t/yr, and rutile, 21,000 t/yr. Depending on market conditions, Kenmare could expand capacity to 1.2 million metric tons per year (Mt/yr) of ilmenite, 80,000 t/yr of zircon, and 30,000 t/yr of rutile (Mozambique News Agency, 2008b; Kenmare Resources plc, 2009, p. 1, 12).

BHP Billiton planned to start its new feasibility study of the Corridor Sands Project, which was based upon deposits of heavy-mineral sands at Chibuto in southern Mozambique. Depending on favorable results of the study, BHP Billiton could produce 250,000 t/yr of titanium slag from ilmenite mined at Chibuto. Full production was not expected until after 2015; capital costs of the first stage of the project were estimated to be between $500 million and $550 million (Mining Journal, 2008b).

Industrial Minerals

Cement.—Cimentos de Mocambique SARL [Cimentos de Portugal, SGPS, SA (Cimpor), 82.46%] produced cement at its Dondo, Matola, and Nacala plants, which together had a total capacity of 710,000 t/yr. In April 2008, Cimpor announced plans to build a kiln at Dondo with a capacity of about 550,000 t/yr and to increase the clinker grinding capacity at Dondo to 600,000 t/yr from 240,000 t/yr. The company also planned to double the grinding capacity at the Matola plant. The expansion at Dondo was expected to be completed by 2010. ARJ Group's cement plant at Nacala had a capacity of 250,000 t/yr; the plant was not operating in late 2008 (table 2; International Cement Review, 2008; Mozambique News Agency, 2008e).

National cement consumption increased to about 900,000 t in 2008 from about 850,000 t in 2007. Production by domestic plants was insufficient to meet demand; the Government suspended the tariff on cement imports for a period of 2 years in December 2008. Cement shortages were particularly severe in the northern provinces of Mozambique; prices were more than twice as high in Niassa as in Maputo (Mozambique News Agency, 2008e; Cimentos de Portugal, SGPS, SA, 2009, p. 96-97).

Diatomite.—Mining of diatomite took place at the Diana quarry, which is located about 10 kilometers (km) southwest of Manhica. Diatomites de Manhica produced processed diatomite; the plant operated substantially below its capacity because of limited domestic markets. Diatomite was used as fertilizer and as an insulator in bakery ovens in Maputo Province (Mozambique News Agency, 2008c).

Gemstones.—Aquamarine, morganite, tourmaline, and other gemstones were mined in Zambezia Province; dumortierite, in Tete Province; and garnet, in Niassa Province. Sociedade Mineira de Cuamba E.E. mined pyrope and pyrope-almandine garnet at Cuamba. In 2007, production at the Cuamba Mine increased to 8,887 kg from 5,730 kg in 2006.

Copper-containing elbaite tourmaline was mined from an alluvial deposit about 3 km northeast of Mavuco in the Alto Ligonha District of Nampula Province. About 600 artisanal miners using labor-intensive methods accounted for most of the production. Mozambique Gems planned to start mechanized mining operations at Mavuco in early to mid-2008 after building a washing plant with a capacity of between 150 and 200 metric tons per day. About 100 artisanal miners produced elbaite and rossmanite tourmaline at an alluvial deposit 13 km northeast of Mavuco. Production amounted to about 50 kilograms per week (Laurs and others, 2008, p. 8, 10-12; Laurs, Zwaan, Simmons, and Falster, 2008).

Morganite, which is a pink beryl that obtains its color from trace amounts of manganese, was produced at the Marropino Mine. Noventa mined 7,274 kg of morganite at Marropino in 2008 compared with 2,613 kg in 2007. The company exceeded its target of 5,000 kg for 2008; the quality of the morganite was substantially less than expected (Noventa Ltd., 2009, p. 3).

Graphite.—The Government initiated a tender to reopen the Ancuabe graphite mine in Cabo Delgado Province in May 2008. The Ancuabe Mine, which operated from 1994 to 1999, shut down because of high power costs. In December, TIMCAL Ltd. of Switzerland was awarded the license to reopen the Ancuabe Mine. The Government and TIMCAL agreed to complete negotiations on the contract by March 2009. By the end of 2008, power costs were expected to decline sharply when the Ancuabe Mine started to receive electricity from the Cahora Bassa hydroelectric plant (Mozambique News Agency, 2008f).

Salt.—Marine salt was produced from evaporation ponds. Salt production declined in 2007 because of machinery

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breakdowns, rain, changes in management, and problems with quality that limited exports to Malawi. In 2007, 93% of domestically produced salt was iodized compared with 74% in 2006 and 44% in 2005 (Government of Mozambique, 2008, p. 79-80; United Nations Children's Fund Mozambique, 2008, p. 17).

Mineral Fuels and Related Materials

Coal.—Vale S.A. (formerly Companhia Vale do Rio Doce) of Brazil planned to produce 11 Mt/yr of coking and thermal coal at the Moatize Mine starting in 2011. The coking coal was likely to be consumed by steel plants in Brazil; thermal coal would be consumed by a new coal-fired powerplant built by Vale at Moatize with a capacity of more than 2,000 megawatts (MW). In the second phase of the project, Vale planned to increase coal production to 21 Mt/yr, of which 14 Mt/yr would be exported and 7 Mt/yr would be consumed domestically. Capital costs of the project were estimated to be $1.4 billion (Mining Journal, 2008b, d).

Development of the Moatize Mine depended upon the reopening of the railway from Moatize to Beria, which was severely damaged during the civil war of the 1980s. The railway was expected to be reopened in mid-2009 at a cost of $375 million (Mining Journal, 2008b).

Riversdale Mining Ltd. of Australia planned to complete its feasibility study of the Benga coal project near Tete by the end of 2008. In September, the company revised its estimate of coal resources at Benga to 2.1 billion metric tons. Depending on favorable results from the study, Riversdale and its joint-venture partner Tata Steel Ltd. of India could open a new mine with a capacity of 20 Mt/yr by the end of 2011. Riversdale planned to use coal from Benga in its new powerplant with an initial capacity of 500 MW; capacity was expected to increase to 2,000 MW by 2015 (Dixon, 2008b; Mining Journal, 2008c).

In May 2008, Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom announced the discovery of a new coal deposit in the Tete Province. Preliminary estimates of resources in five of the eight zones of the deposit were as much as 868 Mt. CAMEC planned further drilling to improve the resource estimate (Mining Journal, 2008b).

In February 2008, Global Steel Holdings Ltd. of India was awarded a 5-year prospecting license in Tete Province. The license was renewable for an additional 5-year period. Reserves in the area covered by the license were estimated to be 70 Mt (Mining Journal, 2008b).

Natural Gas.—Production of natural gas from the Temane gasfield increased to about 3.07 billion cubic meters in 2008 from 2.75 billion cubic meters in 2007. Sasol Ltd. of South Africa, which operated the project, exported most of Temane's output through an 865-km pipeline to supply its South African chemical plants. The company planned to increase production capacity by about 50% by 2010; higher capacity would be at least partially attributable to the startup of the Pande gasfield in 2009. The capacity of the pipeline was likely to increase to 3.89 billion cubic meters from 3.16 billion cubic meters by the end of 2009. Sasol planned to use the increased output from Mozambique to supply its expanded synthetic fuels plant in South Africa (Mozambique News Agency, 2008d; Petroleum Economist, 2008b).

Sasol drilled its first well at offshore Blocks 16 and 19 in October 2008; the company formed a joint venture with Petronas Carigali Overseas Shd. Bhd. of Malaysia and the state-owned Empresa Nacional de Hidrocarbonetos de Mocambique (ENH) to explore in Blocks 16 and 19 in December (Petroleum Economist, 2008a).

Petroleum.—Mozambique produced neither crude petroleum nor refined petroleum products and relied on imports. Ayr Logistics Ltd. of the United States and its joint-venture partners planned to build a new refinery at Nacala. The refinery was expected to have a capacity of 300,000 barrels per day (bbl/d) and to be completed by 2015. Costs were estimated to be $5.5 billion. The refinery's capacity was substantially greater than Mozambique's petroleum products consumption; exports of the refinery's output to southern African countries were likely (Mozambique News Agency, 2008a).

In December 2008, the Government awarded the contract for preliminary studies of a second new refinery to Shell Global Solutions Inc. of the United States. Depending upon successful results of the studies, the refinery was expected to have a capacity of 350,000 bbl/d; construction of the refinery was expected to be completed in 2014 (Petroleum Economist, 2008a).

Petronas signed an agreement with ENH to explore Blocks 3 and 6 in the offshore Rovuma Basin in December 2008. The first phase of the work program involved seismic work and coring (Petroleum Economist, 2008a).

Uranium.—The Mavuzi Mine in northwestern Mozambique produced uranium during the 1950s. Mavuzi Minerals Ltd. of Australia held exploration licenses for the Mavuzi Mine and the surrounding area. In March 2008, Mavuzi Minerals merged with Mantra Resources Ltd. of Australia. Mantra explored for uranium at the Mavuzi, the Meponda, the Mucumbura, the Murrupula, the Niassa, and the Zumbu projects. Mozambique Minerals Ltd. (a subsidiary of Kenmare) explored for uranium at its Tete licenses in the Zambezi valley. At the end of 2008, exploration was on temporary hold (Kenmare Resources plc, 2009, p. 12; Mantra Resources Ltd., 2009, p. 7-9).

Outlook

The mineral industry of Mozambique is likely to experience substantial growth in the near future. Growth is expected to be broadly based, with higher production of gold, ilmenite, rutile, steel, and zircon planned in 2009; cement, natural gas, niobium, and tantalum, in 2010; and coal, from 2011 to 2015. New petroleum refineries were likely to open in 2014 and 2015. Graphite mining could also restart. The outlook for ilmenite, niobium, rutile, tantalum, and zircon could be negatively affected by unstable domestic power supplies or the world economic crisis of 2008. The development of new coal mines also depended on the rehabilitation of the rail network. New mines and related infrastructure could lead to increased consumption and production of local construction materials. The expansion of the Mozal smelter is unlikely before 2013

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because of power shortages in South Africa. Development of the Corridor Sands project also depends upon reliable power supplies.

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TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
Aluminum:						
Bauxite		6,723	9,518	11,069	8,650 [r]	5,443 [3]
Metal, refined		549,000	555,000	564,000	564,000	536,000 [3]
Beryl	kilograms	45,200	146,000	16,400 [r]	30,600 [r]	7,600 [3]
Cement, hydraulic[e]	thousand metric tons	550 [r]	490 [r]	600 [r]	800 [r]	730
Clays:						
Bentonite:						
Crude		3,336	17,318	3,515	9,707 [r]	17,047 [3]
Processed		578	547	692	762 [r]	614 [3]
Brick		108,231	32,031	222,052	230,000 [e]	230,000
Coal, bituminous		16,525	3,417	40,953	23,602 [r]	37,700 [3]
Diatomite[e]		1,300 [r]	1,300 [r]	1,300 [r]	651 [r,3]	379 [3]
Gemstones:						
Aquamarine	kilograms	18	16	14 [r]	14 [r,e]	14
Dumortierite		113	10	664	63 [r]	60
Garnet	kilograms	2,686	2,172	5,730	8,887 [r]	8,900
Morganite	do.	NA	1,750	2,052	2,613	7,274 [3]
Tourmaline	do.	1,570	245	25,138	31,000 [r]	32,000
Gold[4]	do.	56	63	85	97 [r]	298 [3]
Natural gas	million cubic meters	1,309 [r]	2,340 [r]	2,689 [r]	2,751 [r]	3,069 [3]
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	712,095	281,212	95,100 [r]	196,400 [r]	395,600 [3]
Nb content[e]	do.	51,000 [r]	20,000 [r]	6,800 [r]	14,000 [r]	28,000
Ta content[e]	do.	205,000	81,000	27,000 [r]	56,000 [r]	110,000
Quartz	do.	173,478	294,668	195,100	200,000 [e]	200,000
Salt, marine[e]		80,000	140,000 [r]	150,000 [r]	110,000 [r]	110,000
Sands	cubic meters	1,429,743	833,113	1,404,184	1,470,000 [r]	1,500,000
Steel, semimanufactured		--	--	--	--	21,000
Stone:						
Granite	cubic meters	521	2,198	5,500 [r]	5,500 [r,e]	5,500
Gravel and crushed rock	do.	779,581	850,919	1,178,998	1,200,000 [e]	1,200,000
Limestone		1,593,450	654,179	155,871	1,350,000 [r]	1,400,000
Marble:						
Block	cubic meters	617	509	472	535 [r]	540
Slab	square meters	13,666	12,318	12,825	16,647 [r]	17,000
Titanium:						
Ilmenite concentrate		--	--	--	140,515 [r]	328,875 [3]
Rutile concentrate		--	--	--	8,782 [r]	6,552 [3]
Zirconium concentrate		--	--	--	26,347 [r]	32,985 [3]

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Table includes data available through September 28, 2009.

[2]Other gemstones, such as amethyst and topaz, were produced, but available information is insufficient to estimate production.

[3]Reported figure.

[4]Does not include unreported production; total output of gold was estimated to be roughly 600 to 900 kilograms per year.

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TABLE 2
MOZAMBIQUE: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Aluminum		Mozambique Aluminum SARL (BHP Billiton Ltd., 47%)	Mozal smelter at Beluluane	506,000.
Bauxite		E.C. Meikles (Pty) Ltd.	Monte Snuta	12,000.[e]
Bentonite		Cia Desenvolvimento Mineira	Boane	30,000.
Cement		Cimentos de Moçambique, SARL [Cimentos de Portugal, SGPS, SA (Cimpor), 82.46%]	Dondo, Matola, and Nacala	710,000.
Do.		ARJ Group	Nacala[2]	250,000.
Coal, bituminous		Carbomoc E.E. (Government owned)	Chipanga XI Mine at Moatize	60,000.
Diatomite		Diatomites de Manhica	Diana quarry near Manica	NA.
Garnet	kilograms	Sociedade Mineira de Cuamba E.E.	Cuamba	8,900.[e]
Gold	do.	Agrupamento Mineiro (joint venture of Companhia Mineira de Gile and Metais de Moçambique)	Manica District	720.
Do.	do.	Artisanal miners	do.	600.
Graphite		TIMCAL Ltd.	Ancuabe[2]	10,000.
Marble, block	cubic meters	Marmonte E.E.	Pemba	1,500.
Morganite	kilograms	Noventa Ltd.	Marropino	5,000.[e]
Natural gas	million cubic meters	Sasol Ltd. (70%)	Temane	3,280.
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate	kilograms	Noventa Ltd. (Highland African Ventures Ltd., 36.7%)	Marropino	160,000 Ta_2O_5.
Steel, semimanufactured		ArcelorMittal South Africa Ltd.	Trem de Varao plant at Maputo[2]	35,000.
Titanium		Kenmare Resources plc	Moma Mine in Nampula Province	800,000 ilmenite; 21,000 rutile.
Tourmaline	kilograms	Artisanal miners	13 kilometers northeast of Mavuco	2,600.[e]
Do.	do.	do.	3 kilometers northeast of Mavuco	NA.
Zirconium		Kenmare Resources plc	Moma Mine in Nampula Province	56,000 zircon.

[e]Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.
[1]Abbreviations used in this table for commodities include the following: Ta_2O_5—tantalum oxide.
[2]Not operating at the end of 2008.

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The Mineral Industry of Namibia

By Omayra Bermúdez-Lugo

Diamond remained the most economically significant mineral commodity to Namibia's economy. In 2008, Namibia was the second ranked producer of gem-quality diamond in terms of dollars per carat, the sixth ranked producer of gem-quality diamond in terms of the total value of diamond production, and the eighth ranked producer of diamond in terms of volume. Namibia was also the fourth ranked producer of uranium, producing about 10% of the world's uranium. Other metals produced in the country included arsenic, copper, gold, lead, manganese, silver, tantalite, tin, and zinc. Industrial minerals included dolomite, fluorspar, granite, marble, salt, semiprecious stones, sodalite, sulfur, and wollastonite (Kimberley Process Certification Scheme, 2009; World Nuclear Association, 2009).

The Ministry of Mines and Energy and its Diamond Affairs, Energy, and Mining Directorates regulate Namibia's mining and petroleum industries. The Ministry grants exploration and mining licenses for minerals in Namibia, compiles national exploration and mining databases, and develops exploration and mining policy and regulations. The Ministry's Geological Survey of Namibia undertakes geologic mapping and research. The Ministry of Trade and Industry is responsible for regulating manufacturing activity, which includes mineral beneficiation, the production of cement, and the processing of semiprecious stones. The Ministry of Trade and Industry also promotes resource-based development.

Production

In the metals sector, the most significant increase in output was for lead concentrates, which increased by 33.4% compared with 2007 output levels, and copper concentrate, which increased by 17%; the output of manganese and zinc concentrates decreased by 40% and 17.3%, respectively. Output levels for most industrial minerals decreased during the year with the exception of sodalite, marble, and diamond, which showed increases of 129%, 108%, and 17.3%, respectively. Data on mineral production are in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities. More-extensive coverage of the mineral industry of Namibia can be found in the 2006 and 2007 U.S. Geological Survey Minerals Yearbook, volume III, Area reports—International—Africa and the Middle East, which is available on the Internet at http://minerals.usgs.gov/minerals/pubs/country.

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TABLE 1
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Arsenic, white, 99% arsenic trioxide		1,264	89	-- [e]	813 [r]	763
Copper:						
Mine output, concentrate (26%–30% Cu):						
Gross weight		58,792	40,542	25,000 [e]	32,450 [r]	37,956
Cu content		11,174	10,157	6,262	6,580 [r]	7,471
Metal, blister:						
From domestic concentrates[e]		11,000	10,000	6,200	8,000	NA
From imported toll concentrates[e]		13,700	13,600	15,700	12,600	NA
Total		24,704	23,551	21,918	20,600 [e]	16,271 [p]
Gold, Au content of mine output	kilograms	2,205	2,703	2,790	2,496 [r]	2,126
Lead, mine output, concentrate:						
Gross weight		27,338	24,689	21,402	21,875 [r]	27,656
Pb content of Pb and Pb-Zn concentrates		14,338	14,320	11,830	10,543 [r]	14,062
Manganese, mine output, gross weight		--	7,320	18,919	47,620 [r]	28,387

See footnotes at end of table.

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TABLE 1—Continued
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS—Continued						
Silver:						
Mine output, Ag content of concentrates	kilograms	27,153	30,003	31,307	30,000 e	30,000 e
Metal, refined, primary[3]	do.	14,815	--	--	--	--
Tantalite:						
Gross weight, concentrates[e]		30	--	--	--	--
Ta content (36%)		11 e	--	--	--	--
Tin:						
Gross weight, concentrates		25 e	--	--	--	--
Sn content (60%)		15 e	--	--	--	--
Zinc:						
Gross weight, mine output, concentrate (49%–56% Zn)		123,372	126,123	100,000 e	94,323 r	92,190
Zn content of Zn and Pb-Zn concentrates[4]		66,028	69,368	55,455	46,335 r	38,319
Metal, refined, primary		120,533	132,818	129,897	150,080	145,396
INDUSTRIAL MINERALS						
Diamond	thousand carats	2,004	1,902	2,356	2,266	2,435
Fluorspar, acid grade (97% $CaFl_2$)[5]		104,785	114,886	132,249	118,766	118,263
Salt		754,351	573,248	603,501	810,942 r	732,000
Semiprecious stones:[e]						
Agate		158 6	150	150	141 r,6	141 6
Amethyst	kilograms	41,367 6	40,000	40,000	7,020 r,6	7,000 e
Blue chalcedony	do.	69 6	50	50	5 r,6	5 6
Garnet	do.	115 6	100	100	88 r,6	-- 6
Picture stone		240 6	200	200	200	200
Pietersite		9 6	--	--	17 r,6	23 6
Rose quartz		--	--	--	22,878 r,6	19,975 6
Sodalite		--	--	--	104 r,6	1,450 6
Tourmaline	kilograms	102 3	100	100	100	100
Stone:						
Dolomite		13,536	14,000 e	14,000 e	27,150 r	27,000 e
Granite		25,492	21,380	21,000 e	36,390 r	22,664
Marble		8,356	5,112	5,100 e	4,538 r	9,438
Sodalite		138	100	100 e	--	--
Sulfur, pyrite concentrate:						
Gross weight (49%–51% S)		3,658	1,035	-- e	8,500 e	8,500 e
S content		1,835	520	-- e	4,300 e	4,000 e
Wollastonite		406	253	55	55 e	50 e
MINERAL FUELS AND RELATED MATERIALS						
Uranium, U_3O_8 content		3,583	3,711	3,617	3,680 r	5,074

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Table includes data available through October 9, 2009.

[2]In addition to the commodities listed, Namibia produced blister copper, which contained gold and silver coproducts, and lead dusts, but available information is inadequate to estimate output.

[3]Includes products of imported concentrate.

[4]Ore from the Skorpion Mine is leached on site and the zinc is recovered by solvent extraction-electrowinning; the zinc ore mined at Skorpion is therefore not included in the zinc concentrate data.

[5]Fluorspar production shown in wet metric tons; approximately 9% moisture content.

[6]Reported figure.

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TABLE 2
NAMIBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper:				
Copper concentrates		Weatherly Mining Namibia Ltd. (Weatherly International plc, 100%)	Central operations, includes the Otjihase Mine and concentrator, about 30 kilometers north of Windhoek; and the Matchless Mine, 80 kilometers southwest of the Otjihase Mine	1,000,000
Do.		do.	Northern operations, includes the Tschudi and the Tsumeb West Mines, and the and the Tsumeb concentrator	500,000
Do.		do.	Kombat operations, includes Kombat Mine and concentrator, 440 kilometers north of Windhoek	400,000
Metal, blister copper		Namibia Custom Smelters (Pty.) Ltd. (Weatherly International plc, 100%)	Smelter at Tsumeb	30,000
Diamond	carats	Namdeb Diamond Corporation (Pty.) Ltd. (Government, 50%, and De Beers Centenary AG, 50%)	Mining Area 1, from Orange River to 145 kilometers north of Orangemund; includes Pocket Beaches	1,000,000
Do.	do.	do.	Northern Areas and Elizabeth Bay Mines, 24 kilometers south of Luderitz	180,000
Do.	do.	do.	Orange River Mines, from mouth of Orange River east to Sendelingsdrif; includes the Auchas and the Daberas Mines	120,000
Do.	do.	do.	Beach and marine contractors	68,000
Do.	do.	De Beers Marine Namibia [De Beers Centenary AG, 70%, and Namdeb Diamond Corporation (Pty.) Ltd., 30%]	Atlanta 1 license area, offshore Sperrgebiet	1,050,000
Do.	do.	Sakawe Mining Corp. (LL Mining Corp. BV)	Offshore mining licenses, near Luderitz Bay	260,000
Do.	do.	Joint venture of Diamond Fields (Pty.) Ltd. (Diamond Fields International Ltd., 100%), and Bonaparte Diamond Mines NL	Mining License 111, offshore Luderitz	NA
Do.	do.	Diaz Exploration (Pty.) Ltd.	Offshore operation	15,000
Fluorspar, acid grade		Okorusu Fluorspar (Pty.) Ltd. (Solvay Fluor GmbH, 100%)	Mine and plant at Okorusu	105,000
Gold:				
Ore		AngloGold Ashanti Namibia (Pty.) Ltd.	Navachab Mine, 170 kilometers northwest of Windhoek	1,440,000
Metal	kilograms	Namibia Custom Smelters (Pty.) Ltd. (Weatherly International plc, 100%)	Coproduct contained in blister copper produced at the copper smelter at Tsumeb	400
Lead, Pb content of concentrate		Rosh Pinah Zinc Corporation (Pty.) Ltd. [Exxaro Resources Ltd., 93.9%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	20,000
Pyrite, concentrate		Weatherly Mining Namibia Ltd. (Weatherly International plc, 100%)	Otjihase Mine and concentrator, near Tsumeb	32,000
Salt:		Salt & Chemicals (Pty.) Ltd. [Walvis Bay Salt Holdings (Pty.) Ltd., 100%]	Salt pan at Walvis Bay	670,000
Do.		Walvis Bay Salt Refiners (Pty.) Ltd. [Walvis Bay Salt Holdings (Pty.) Ltd., 100%]	Salt refinery at Walvis Bay	650,000
Do.		Salt Company (Pty.) Ltd.	Swakopmund	120,000
Do.		Cape Cross Salt (Pty.) Ltd.	North of Henties Bay	40,000

See footnotes at end of table.

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TABLE 2—Continued
NAMIBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Silver:			
Concentrate, Ag content	Rosh Pinah Zinc Corporation (Pty.) Ltd. [Kumba Resources Ltd., 89.5%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	25
Metal	Namibia Custom Smelters (Pty.) Ltd. (Weatherly International plc, 100%)	Coproduct contained in blister copper produced at the copper smelter at Tsumeb	23
Uranium, uranium oxide	Rössing Uranium Ltd. (Rio Tinto Group, 68.6%; Government of Iran, 15%; Industrial Development Corp. of South Africa Ltd., 10%; Government of Namibia, 3.5%)	Rössing Mine, 65 kilometers northeast of Swakopmund	4,800
Do.	Langer Heinrich Uranium (Pty.) Ltd. (Paladin Energy Ltd., 100%)	Langer Heinrich Mine. 80 kilometers east of Walvis Bay	1,180
Wollastonite	Namibia Mineral Development Co. (Pty.) Ltd.	Usakos Mine	800
Zinc:			
Mine:			
Concentrate, Zn content	Rosh Pinah Zinc Corporation (Pty.) Ltd. [Exxaro Resources Ltd., 93.9%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	110,000
Ore	Skorpion Mining Co. (Pty.) Ltd. (Anglo American plc, 100%)	Skorpion Mine, 25 kilometers north of Rosh Pinah	1,500,000
Metal	Namzinc (Pty.) Ltd. (Anglo American plc, 100%)	Skorpion solvent extraction facilities and electrowinning refinery, 25 kilometers north of Rosh Pinah	150,000

Do., do. Ditto. NA Not available.

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The Mineral Industry of Nigeria

By Philip M. Mobbs

As Africa's leading crude oil producer, Nigeria accounted for 21% of African and about 2.7% of total world crude oil production. In 2008, crude oil output decreased by 4%. The financial effect of the decrease in Nigerian crude oil production in 2008 was offset by the increase in the prices received for crude oil. According to the Central Bank of Nigeria (2009, p. 247), the average price of Bonny Light, which is a Nigerian crude oil standard, rose to $101.15 per barrel in 2008 compared with $74.96 per barrel in 2007. Gross Government revenue from hydrocarbons increased to $54.9 billion[1] compared with $35.5 billion in 2007 (BP p.l.c., 2009, p. 9; Central Bank of Nigeria, 2009, p. 219).

The Federal Government holds all mineral rights and is responsible for the allocation of exploration and development licenses. The Minerals and Mining Act, 2007 and the Petroleum Act of 1969 form the legal basis for exploration and production activity in the mineral sector. In 2008, the National Gas Master Plan became effective and the National Gas Pricing Policy and Regulations was promulgated.

Minerals in the National Economy

Nigeria has produced crude oil for the past 50 years, since the initial production from the Oloibiri field in 1958. According to provisional data compiled by the National Bureau of Statistics, crude oil and natural gas activity accounted for about 39% of the nominal Nigerian gross domestic product in 2008; solid mineral production accounted for about 0.15%. Hydrocarbons also accounted for 99% of total exports and 83% of Government revenues. In an attempt to diversify the economy, Government policy continued to emphasize that investment in the exploration for and development of solid mineral (as opposed to natural gas and oil) deposits should be a strategic goal of the Nigerian economy (Central Bank of Nigeria, 2009, p. 234).

Total official exports in 2008 were provisionally valued at about $80.6 billion in 2008 compared with $65 billion in 2007. The value of exported crude oil was $74.3 billion in 2008 compared with $58 billion in 2007. The value of natural gas exports decreased slightly in 2008 to $5.51 billion from $5.56 billion in 2007. According to state-owned Nigerian National Petroleum Corp. (NNPC) (2009, p. 11), the United States received 44% of the total official crude oil exports from Nigeria; India received 10%; Brazil, about 7%; Spain, 5%; and France, about 5%. Theft from crude oil and refined petroleum product pipelines was estimated to have dropped to 14,000 barrels per day (bbl/d) in 2008 from 80,000 bbl/d in 2007. Much of the stolen oil was illegally exported (Quinlan, 2008; Walker, 2008; Central Bank of Nigeria, 2009, p. 250, 262).

[1]Where necessary, values have been converted from Nigerian naira (₦) to U.S. dollars (US$) at the average rates of ₦119.07=US$1.00 for 2008 and ₦125.72=US$1.00 for 2007.

Production

In 2008, aluminum production resumed at the Aluminum Smelter Co. of Nigeria, Ltd. (ALSCON), which had ceased operations in 1999. Kaduna Refinery and Petrochemicals Co. Ltd. and Warri Refinery and Petrochemicals Co. Ltd. also resumed operations in 2008, which resulted in the significant increase in the output of refined petroleum products. Crushed stone (aggregate), gold, lead-zinc ore, limestone, and sand output also increased in 2008. The continued decrease in crude oil production was attributed to the civil disturbances in the Niger Delta region, criminal violence directed at the international oil company facilities and personnel, the decline in international demand, and repeated vandalism of domestic crude oil, natural gas, and petroleum products pipelines. Gypsum output was estimated to have decreased significantly in 2008 (table 1; Central Bank of Nigeria, 2009, p. 105; Nigerian National Petroleum Corp., 2009, p. x, xiii).

Structure of the Mineral Industry

The Ministry of Mines and Steel Development manages much of the solid minerals sector. The Federal Ministry of Commerce and the Federal Ministry of Industry were merged in 2007 to form the Federal Ministry of Commerce and Industry, which manages the cement sector. The Federal Ministry of Energy is responsible for the oversight of the natural gas, petroleum, and power sectors. NNPC was the major partner in natural gas and petroleum production joint ventures with subsidiaries of large international oil companies, such as Chevron Corp. and Exxon Mobil Corp. of the United States, Eni SpA of Italy, Royal Dutch Shell plc of the United Kingdom, and Total S.A. of France. Crude oil also was produced under production-sharing contracts, service contracts, and by sole risk operators (primarily independent domestic companies). Most Nigerian natural gas output was produced as a coproduct of crude oil production.

Commodity Review

Metals

Aluminum.—United Company RUSAL of Russia, which held 77.5% interest in ALSCON, continued to refurbish the ALSCON smelter, which had closed in 1999. In February 2008, production resumed with about 40 reduction cells of the 432 cells online. The ALSCON smelter was expected to reach full production capacity by 2010 (Mukumbira, 2008).

Iron and Steel.—In April, the Government cancelled the 10-year concession agreement to manage Ajaokuta Steel Co. Ltd. and National Iron Ore Mining Co. that had been awarded in 2004 to Global Steel Holdings Ltd. (formerly known as Global Infrastructure Holdings Ltd.). Global Steel subsequently filed the issue with the International Court of Arbitration. Global

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Steel also was under investigation for its operation of Delta Steel Co. Ltd. (Guardian Newspapers Ltd., 2008).

Construction of Western Metal Products Company Ltd.'s 750,000-metric-ton-per-year (t/yr)-capacity rolling mill at Ibafon, Ogun State, was underway, and Designed Stainless Product Ltd. started construction of a stainless steel mill in Abuja. MINL Ltd., which produced aluminum and galvanized steel sheets, expected that its 200,000-t/yr-capacity concrete-reinforcing bar (rebar) rolling mill in Ota, Ogun State, would be producing rebar in 2009. BSS Steel Rolling Mill Ltd. proposed to build a 300,000-t/yr-capacity rolling mill in Abese, Ogun State (Alli, 2008; Metal Bulletin, 2008; This Day Online, 2008).

Mineral Fuels

Natural Gas and Petroleum.—In 2008, the Oil and Gas Sector Reform Implementation Committee submitted a report that reviewed Nigerian hydrocarbon policies and suggested regulatory and structural reforms. The report formed the basis for the Petroleum Industry Bill, which was expected to be introduced to the National Assembly in 2009.

In 2008, the NNPC joint venture operated by Mobil Producing Nigeria Unlimited again was Nigeria's leading crude oil producer, followed by the NNPC joint venture that was operated by Shell Petroleum Development Co. of Nigeria Ltd.; the NNPC joint venture that was operated by Chevron, and the NNPC joint venture that was operated by Total S.A.'s subsidiary Elf Petroleum Nigeria Ltd. Many of the onshore operations in the western Niger River delta region remained suspended in 2008 because of the ongoing civil unrest. Because of the attacks on offshore and onshore facilities, shutin (not producing) crude oil production capacity in 2008 was estimated to have ranged from 700,000 bbl/d to 1.1 million barrels per day. Reported incidents of pipeline sabotage in Nigeria, however, decreased in 2008 to 2,285 incidents, which was down from 3,224 in 2007 (Ebiri and others, 2008; Nigerian National Petroleum Corp., 2009, p. 32; Platts.com, 2009).

In 2008, natural gas began to flow from Nigeria through the West African gas pipeline to Ghana. Also in 2008, crude oil production was initiated from the 100,000-bbl/d Chevron-operated offshore Agbami field. Output was expected to reach 250,000 bbl/d in 2009. Afren plc started production of 3,000 bbl/d from the offshore Okoru Setu field. The production capacity of the field was expected to reach 15,000 bbl/d. The joint venture of Mobil and NNPC started production from the East Areas Natural Gas Liquids II project. Located about 28 kilometers offshore, the project was expected to produce 50,000 bbl/d of natural gas liquids when full production levels were reached (Afren plc, 2008; Exxon Mobil Corp., 2008; Petroleum Economist, 2008b).

Operations at the Warri refinery resumed in February and at the Kaduna refinery in March; these refineries had operated only intermittently since early 2006 owing to crude-oil-supply pipeline damages, which resulted in a lack of oil to refine. The Government approved the construction of new crude oil refineries at Eket, Akwa Ibom State, and in Lagos State. Despite the Government's revocation in 2007 of 18 provisional licenses to build privately owned crude oil refineries because of the lack of progress on the projects, several planned or proposed refinery projects remained active. These included the projects of Amakpe International Refineries Nigeria Ltd. in Akwa Ibom State, Antonio Oil Company Ltd. in Ogun State, Batun Oil and Gas Ltd. in Lagos State, Orient Petroleum Resources Plc. in Anambra State, National Independent Petroleum Co. at a site to be determined, and Tonwei Refinery Ltd. in Baylesa State.

In May, Mobil and Shell were notified that the Government considered that the companies owed the Government an additional $1.91 billion under the production-sharing agreements for production from (respectively) the Erha and the Bonga fields. At yearend, the companies and NNPC continued talks on the contracts that covered operations in these fields (Petroleum Economist, 2008a).

Outlook

In 2008, the Government's action to diversify the mineral sector included the updated Mining Law, the ongoing reorganization of state-owned companies in the mineral sector, and efforts to attract domestic and foreign investors to explore for and to exploit economic mineral deposits. The ongoing civil unrest in southern Nigeria, however, is expected to continue to adversely affect international investor interest in the Nigerian solid minerals sector.

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TABLE 1
NIGERIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Aluminum		--	--	--	--	20,000
Gold	kilograms	30	30	50	180 r	200
Iron ore, gross weight	thousand metric tons	--	60	88 4	58 4	62 4
Lead:						
Lead-zinc ore		200	--	492,000 4	582,000 4	644,000 4
Metal, refined		5,000	5,000	5,000	5,000	5,000
Niobium (columbium) and tantalum concentrates:						
Gross weight		100	99	110	180	194 4
Niobium (columbium) content		40	35	40	70	75
Steel		40,000	100,000	500,000	500,000	500,000
Tin:						
Mine output, cassiterite concentrate:						
Gross weight		1,300	1,700	1,818 4	229 4	240 4
Sn content		1,000	1,300	1,400	180	185
Metal, smelter		25	25	--	--	--
INDUSTRIAL MINERALS						
Barite[5]		6,000	6,000	6,300	5,000	5,000
Cement, hydraulic	thousand metric tons	2,300	2,700	3,300	4,700	5,000
Clays:						
Kaolin		58,000	93,000	100,000	100,000	100,000
Unspecified		150,000	150,000	160,000	234,000 r	251,000 4
Feldspar		1,000	1,100	1,700 r	1,700 r	1,700
Gypsum		160,000	150,000	169,000	579,000 4	300,000
Sand and stone:						
Granite	thousand metric tons	2,000	2,000	--	--	--
Limestone	do.	2,100	1,200	1,500 r, e	3,300 4	3,960 4
Marble	do.	150	149	200	200	200
Sand	do.	905	900	941	1,723 4	1,960 4
Stone, crushed (aggregate)	do.	2,206 4	2,000	1,636 4	2,924 4	3,583 4
Shale	do.	1,200	1,200	1,300	83	91 4
Topaz	kilograms	10	--	10	10	10
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		--	8,000	530,000	530,000	500,000
Natural gas:						
Gross	million cubic meters	57,747 4	57,369 4	57,754 4	68,404 4	66,632 4
Dry	do.	34,411 4	34,744 4	39,000	46,046 4	46,759 4
Petroleum:						
Crude	thousand 42-gallon barrels	900,400 4	923,500 4	869,197 4	803,000 4	768,800 4
Refinery products:						
Liquefied petroleum gases	do.	20 4	700	NA	16 4	300 4
Gasoline	do.	4,600 4	14,800	8,500	2,450 4	5,958 4
Kerosene	do.	4,900 4	10,100	6,100	2,550 4	5,179 4
Distillate fuel oil	do.	8,800 4	15,800	9,400	4,645 4	8,698 4
Residual fuel oil	do.	12,400 4	19,200	14,400	6,670 4	9,629 4
Unspecified	do.	3,400 4	4,300	1,000	1,681 4	3,383 4
Total	do.	34,100 4	65,000	39,400	18,012 4	33,147 4

rRevised. do. Ditto. NA Not available. -- Zero.
[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through January 12, 2010.
[3]In addition to the commodities listed, amethyst, aquamarine, bitumen, copper (secondary), diamond, emerald, garnet, ilmenite, lime, monazite, phosphate rock, rolled-steel products, ruby, rutile, sapphire, soda ash, talc, tourmaline, tungsten, and zircon are produced, but available information is inadequate to estimate output.
[4]Reported figure.
[5]Considerably more barite is produced but it is considered to be commercially unusable.

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TABLE 2
NIGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Aluminum Smelter Co. of Nigeria, Ltd. (ALSCON) (United Company RUSAL, 77.5%)	Smelter at Ikot Abasi	193,000 [1]
Cement		Obajana Cement Plc (Dangote Group)	Lines 1 and 2 at Obajana	5,000,000 [2]
Do.		United Cement Co. of Nigeria (Egyptian Cement Co., 70%, and Flour Mills of Nigeria Ltd., 30%)	Calbar cement plant, Mfamosing	2,500,000 [3]
Do.		West Africa Portland Cement Co. Plc (Lafarge S.A., 59.95%)	Ewekoro	1,320,000
Do.		Ashakacem Plc (Lafarge S.A., 50.11%)	Ashaka	900,000
Do.		Benue Cement Co. Plc (Dangote Group)	Benue State	900,000 [4]
Do.		West Africa Portland Cement Co. Plc (Lafarge S.A., 59.95%)	Shagamu	600,000
Do.		Cement Co. of Northern Nigeria Plc (Damnaz Cement Company Ltd., 50.7%)	Sokoto	500,000
Do.		Edo Cement Co. Ltd. (Damnaz Cement Company Ltd., 87%)	Okpella	450,000
Do.		United Cement Co. of Nigeria (Egyptian Cement Co., 70%, and Flour Mills of Nigeria Ltd., 30%)	Clinker grinding plant, Calbar	350,000
Coal		Kogi State government	Ogboyoga Mine	NA
Copper, secondary		Sun & Sand Industries Ltd.	Otta	NA
Fertilizer:				
Single superphosphate		Heikio Consortium Ltd.	Kaduna	100,000 [1]
Urea		Notore Chemical Industries Ltd.	Onne	600,000 [1]
Iron and steel:				
Iron ore		National Iron Mining Co. Ltd. (Government, 100%)	Itakpe	5,500
Steel:				
Steel, crude		Ajaokuta Steel Co. Ltd. (Government, 100%)	Blast furnace at Ajaokuta	1,350,000 [1]
Do.		Delta Steel Co. Ltd. (Global Steel Holdings Ltd.)	Electric arc furnaces at Aladja	1,000,000
Do.		African Steel Mills Ltd. (Liberty Group)	Electric arc furnace at Ikorodu	170,000
Do.		Federated Steel Mills Ltd.	Electric arc furnace at Ikeja	140,000
Do.		Nigerian Spanish Engineering Co.	Electric arc furnace at Kano	100,000
Do.		Sankyo Steel Mill Company Ltd.	Electric arc furnace at Ikeja	80,000
Do.		Continental Iron and Steel Co.	do.	60,000
Do.		Universal Steel Co.	do.	50,000
Rolling mills		Delta Steel Co. Ltd. (Global Steel Holdings Ltd.)	Aladja	300,000
Do.		Jos Steel Rolling Co. Ltd. (Zuma Steel West Africa Ltd.)	Jos rolling mill	210,000 [1]
Do.		Katsina Steel Rolling Co. Ltd. (Dana Steel Ltd.)	Katsina rolling mill	207,000 [1]
Do.		Oshogbo Steel Rolling Co. Ltd. (Kura Holdings Ltd.)	Oshogbo rolling mill	210,000 [1]
Do.		Ajaokuta Steel Co. Ltd. (Government, 100%)	Ajaokuta	130,000
Do.		African Steel Mills Ltd. (Liberty Group)	Rolling mill at Ikorodu	100,000
Do.		Sunflag Steel (Nigeria) Ltd.	Rolling mill at Lagos	30,000
Natural gas, liquefied	million metric tons	Nigeria Liquefied Natural Gas Ltd. [Nigerian National Petroleum Corp. (NNPC), 49%; Shell Gas B.V., 25.6%; Total LNG Nigeria Ltd., 15%; ENI International (N.A.) S.a.r.l., 10.4%]	Trains 1 through 5 at Finima, Bonny Island	17
Do.	do.	do.	Train 6 at Finima, Bonny Island	4 [3]
Do.	do.	Brass LNG Ltd. [Nigerian National Petroleum Corp. (NNPC), 49%; Brass Holdings Co. Ltd., 17%; ENI International (N.A.) S.a.r.l., 17%; Phillips (Brass) Ltd., 17%]	Trains 1 and 2 on Brass Island	10 [3]
Niobium (columbium) and tantalum		Artisanal miners	Jos region	NA
Petroleum:				
Crude	million 42-gallon barrels	Produced under various joint ventures with Nigerian National Petroleum Corp. (NNPC), production-sharing contracts, service contracts, and sole risk operations	Niger Delta and offshore	980
Refined petroleum products	do.	Port Harcourt Refining Co. Ltd. (Government, 100%)	New Port Harcourt refinery	55
Do.	do.	do.	Old Port Harcourt refinery	22
Do.	do.	Warri Refinery and Petrochemicals Co. Ltd. (Government, 100%)	Warri refinery	43
Do.	do.	Kaduna Refinery and Petrochemicals Co. Ltd. (Government, 100%)	Kaduna refinery	38
Tin		Artisanal miners	Mines at Dutse Nkura	30
Do.		do.	Mines at Gurum, near Jos	30

Do., do. Ditto. NA Not available.
[1]Under rehabilitation.
[2]Construction of Lines 3 and 4 with an additional annual capacity of 5 million metric tons was suspended at yearend.
[3]Under construction.
[4]Expansion to 2.7 million metric tons per year is underway.

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The Mineral Industry of Rwanda

By Thomas R. Yager

Rwanda was not a globally significant consumer of minerals. In 2008, however, Rwanda's share of the world's tantalum mine production amounted to about 5%, and tungsten, 4%. In 2007 (the latest year for which data were available), the mining and quarrying sector accounted for less than 0.8% of the gross domestic product. About 50,000 Rwandans were employed in the mining sector in 2007. Rwanda's exports of cassiterite (tin ore), columbite-tantalite, and wolframite (tungsten ore) were from domestic mining operations and reexports from mining operations in Congo (Kinshasa) (Banque Nationale du Rwanda, 2008, p. 25-26; Garrett and Mitchell, 2009, p. 39-41; Mukaaya, 2009; Papp, 2009; Shedd, 2009).

Production

In 2008, tin mine production increased by an estimated 22%. In 2007, niobium (columbium) and tantalum mine production increased by about 160% each, and tungsten, by an estimated 107% compared with that of 2006. The production of natural gas restarted in 2008 (Banque Nationale du Rwanda, 2008, p. 31, 33; Garrett and Mitchell, 2009, p. 37).

Structure of the Mineral Industry

The state-owned Régie d'Exploitation et de Développement des Mines (REDEMI) produced cassiterite (tin ore), columbite-tantalite, and wolframite (tungsten ore); privately owned companies and artisanal miners also produced these mineral commodities. In 2006, the Government privatized 20 of REDEMI's concessions. The privately owned Cimenterie du Rwanda (Cimerwa) was the country's only cement producer.

Commodity Review

Metals

Gold and Nickel.—TransAfrika Resources Ltd. of South Africa held concessions in the Gicumbi and the Rusizi Districts in the north and southwest, respectively. In July 2008, TransAfrika started drilling for gold in the Gicumbi District following a soil sampling program. The company planned to explore for gold in the Rusizi District and for nickel in the Kayonza and the Kirehe Districts in the east. Coopexmi SARL, Kivu Gold Corp. of Canada, and Rogi Mining Ltd. of Russia also started gold exploration (Mukaaya, 2008a; Africa Mining Intelligence, 2009).

Niobium (Columbium) and Tantalum.—Columbite-tantalite was mined in the Gatsibo and the Kamonyi Districts by companies that included Eurotrade International SA, Munsad Minerals, and Natural Resources Development Rwanda Ltd. (NRD). H.C. Starck of Germany purchased a controlling share in NRD. From 2003 to 2007, national production of columbite-tantalite increased to 490 metric tons (t) from 118 t. Exports increased to $39 million in 2008 from $19 million in 2007 (Pourtier, 2004, p. 31; Africa Mining Intelligence, 2009; Garrett and Mitchell, 2009, p. 37).

Tin.—Cassiterite was mined in 26 of Rwanda's 30 districts; exploration was active in 185 permits at the end of 2008. From 2003 to 2007, national cassiterite production increased to 1,141 t from a revised 283 t; the increase was attributable to new producers. Small cooperatives and mining associations produced 429 t in 2007; Centrale Multi Services, 174 t; and Munsad Minerals, 130 t. Production of cassiterite by Coopérative de Promotion de l'Industrie Minière Artisanal (COPIMAR) decreased to 64 t in 2007 from 106 t in 2003, and by REDEMI, to 87 t from 168 t. The country's exports increased to $72 million in 2008 from $31.9 million in 2007 (Pourtier, 2004, p. 31; Mukaaya, 2008a; Africa Mining Intelligence, 2009; Garrett and Mitchell, 2009, p. 37-38).

Tungsten.—From 2003 to 2007, national wolframite production increased to 2,988 t from a revised 109 t. COPIMAR and REDEMI accounted for a combined 83% of Rwanda's output in 2003; the increase was attributable to new producers, such as Africa Primary Tungsten SARL, Eurotrade International S.A., Pyramid International, Rwanda Allied Partners, and Wolfram Bergbau- und Hütten GmbH Nfg. Eurotrade International produced wolframite at Gifurwe and Nyakabingo. In 2008, Rwanda's wolframite exports decreased to $14 million from $19 million in 2007 (Pourtier, 2004, p. 31; Africa Mining Intelligence, 2009; Garrett and Mitchell, 2009, p. 37).

Industrial Minerals

Cement.—Rwanda experienced cement shortages in 2008; Cimerwa [a subsidiary of Rwanda Investment Group (RIG)] was unable to meet domestic demand in spite of producing at about its full capacity of 100,000 metric tons per year (t/yr). Cement was imported from Kenya and Uganda. Cimerwa planned to complete a new plant with a capacity of 600,000 t/yr by June 2010 (Mukaaya, 2008b).

Mineral Fuels

Natural Gas.—State-owned company Kibuye Power 1 Ltd. extracted natural gas from Lake Kivu for use at a local gas-fired power station with a capacity of 5 megawatts (MW). The company produced at 30% of capacity at the power station in 2008, of which two-thirds was available for the local power grid. RIG planned to build a new gas-fired power station with an initial capacity of 5 MW that would use natural gas from Lake Kivu. Production was planned to start in November 2008; equipment for the extraction of gas sank in Lake Kivu in early November. RIG planned to start production with new equipment in August 2009 (Africa Energy Intelligence, 2008).

Peat.—Cimerwa planned to use peat as a source of energy in its new plant; fuel and electricity accounted for about 70%

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of the current plant's total costs. RIG's subsidiary Peat Energy Co. planned to start producing 24,000 t/yr of peat starting by the end of February 2009 following the completion of a feasibility study in early 2008. Production was expected to increase with the expansion of Cimerwa in 2010 (Mukaaya, 2008b; Rwanda Investment Group S.A., undated).

Petroleum.—In 2008, Vangold Resources Ltd. of Canada engaged in an initial airborne magnetic survey in the East Kivu Graben Basin. Vangold was able to complete about 70% of the survey; the company was unable to finish its work because of instability in Congo (Kinshasa) (Vangold Resources Ltd., 2008).

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TABLE 1
RWANDA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
Cement		104,288	101,128	102,589	103,034	103,244 [3]
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	220,000	276,000	188,000	490,000 [r]	490,000
Nb content[e]	do.	72,000	91,000	62,000	160,000 [r]	160,000
Ta content[e]	do.	45,000	57,000	38,000	100,000 [r]	100,000
Gold, mine output, Au content[e]	do.	5 [r]	10 [r]	15 [r]	17 [r, 3]	20
Natural gas:						
Gross	million cubic meters	(4) [r]	(4) [r]	--	--	NA
Dry	do.	(4)	(4)	--	--	2
Tin:						
Mine output:[e]						
Gross weight		250 [r]	215 [r, 3]	600 [r]	1,141 [r, 3]	1,400
Sn content		190 [r]	170 [r]	470 [r]	899 [r, 3]	1,100
Refined[e]		200	200	50	-- [3]	-- [3]
Tungsten, mine output:						
Gross weight		157	557	1,436	2,988 [r]	3,000
W content		90	320 [r]	820	1,700 [r]	1,700

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Table includes data available through April 26, 2010.

[2]In addition to the commodities listed, sapphire and pozzolanic materials are also known to be produced, but information is inadequate to make reliable estimates of output.

[3]Reported data.

[4]Less than one-half unit.

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TABLE 2
RWANDA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Cimenterie du Rwanda (Cimerwa)	Plant at Cyangugu	100,000
Gold	Eurotrade International S.A.	Nyakabingo	NA
Natural gas, million cubic meters	Kibuye Power 1 Ltd.	Plant at Lake Kivu	11 e
Niobium (columbium) and tantalum, columbite-tantalite ore and concentrate	Various producers, including the following:	Numerous sites, including:	500 e
	Coopérative de Promotion de l'Industrie Minière Artisanale (COPIMAR)	Sites in North and South Provinces	
	Eurotrade International S.A.	Nyakabingo	
	Munsad Minerals	Sites in Gatsibo District	
	Natural Resources Development Rwanda Ltd. (NRD)	Giciye	
	Régie d'Exploitation et de Développement des Mines (REDEMI)	Sites in Gatsibo District	
Sapphire	Artisanal miners	Mines at Cyangugu	NA
Tin:			
Cassiterite, ore and concentrate	Small cooperatives and miners associations	Various sites	430 e
Do.	Natural Resources Development Rwanda Ltd. (NRD)	Ntemba	216
Do.	do.	Giciye, Rutiro, and Sebeya	NA
Do.	Centrale Multi Services	Rwinkwavu	180 e
Do.	Munsad Minerals	NA	130 e
Do.	Artisanal miners	Various sites	110 e
Do.	Régie d'Exploitation et de Développement des Mines (REDEMI)	Rutongo	90 e
Do.	Coopérative de Promotion de l'Industrie Minière Artisanale (COPIMAR)	Sites in North and South Provinces	70 e
Do.	Gatumba Mining Concessions Ltd. (Metal Processing Association, 51%; and Government, 49%)	Gatumba	60
Do.	Rwanda Metals SA	Ntunga	60 e
Do.	Eurotrade International S.A.	Nyakabingo	NA
Refined	Metal Processing Association	Smelter at Gisnyi[1]	200
Tungsten, wolframite ore and concentrate	Various producers, including the following:	Numerous sites, including:	3,000 e
	Africa Primary Tungsten SARL	NA	
	Coopérative de Promotion de l'Industrie Minière Artisanale (COPIMAR)	Sites in North and South Provinces	
	Eurotrade International S.A.	Gifurwe and Nyakabingo	
	Natural Resources Development Rwanda Ltd. (NRD)	Giciye, Rutiro, and Sebeya	
	Pyramid International	NA	
	Rwanda Allied Partners	NA	
	Wolfram Bergbau- und Hütten GmbH Nfg	NA	
	Wolfram Mining & Processing Ltd.	Gifurwe and Rwinkwavu	

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Not operating in 2008.

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The Mineral Industry of Sierra Leone

By Omayra Bermúdez-Lugo

Diamond mining continued to be the most significant mineral commodity to the economy of Sierra Leone, accounting for about 46% of export revenues in 2008. Export revenues from all mining represented 79% of the country's total exports. Rutile exports accounted for 17% of export revenues; bauxite, 13%; gold, 2%; and ilmenite, 1%. Sierra Leone ranked among the world's five leading producers of rutile. Other minerals produced in the country included bauxite, cement, gold, and ilmenite. In 2008, the country continued to recover from years of civil unrest. Mining activities had increased since the end of the civil war in 2002; however, industrialized mining had led to increased competition for land between mining companies and artisanal miners. The estimated number of artisanal miners operating in the country in 2008 was 120,000 (Diamond Development Initiative, 2008, p. 5; Bank of Sierra Leone, 2009, p. 25; Gambogi, 2009).

Government Policies and Programs

The Government of Sierra Leone owns the rights to all minerals in the country. The Ministry of Mineral Resources is the Government entity responsible for the administration of the mineral industry, which includes the issuance of mining licenses, field monitoring, enforcement of mining regulations, and the maintenance of mining records. The Gold and Diamond Department (GDD) within Sierra Leone's National Revenue Authority is responsible for implementing the country's participation in and compliance with the international diamond trade control requirements of the Kimberley Process Certification Scheme. The GDD values and levies export taxes on all diamond that is officially exported from Sierra Leone. The Mines Department monitors and regulates the mining and marketing of precious minerals, and the Geological Survey Division issues prospecting licenses and monitors the activities of exploration companies across the country. Other Ministries involved in the mining sector include the Ministry of Lands, Country Planning, and the Environment, which is responsible for all issues relating to land and property rights and the environment; the Ministry of Local Government and Community Development, which is also responsible for issues concerning land tenure, local Government administration, and disputes over property rights at the local level; and the Ministry of Gender and Children's Affairs, which deals with issues concerning child labor in the mining sector (Diamond Development Initiative, 2008, p. 4-14).

The decentralization of Government power has been ongoing, and local councils at the Provincial, district, and chiefdom levels were becoming increasingly important with regard to many mining-related issues. The Mines Department issues artisanal mining licenses but requires license holders to make subsequent arrangements with traditional rulers, who are the custodians of the land. In the case of leases granted to industrial-scale operations, the Mines Department informs the landowners or community chiefs of the license granted. In districts where there is no cadastre system in place, artisanal mining licenses may be granted for the same locations where prospecting and exploration licenses have already been issued, which in the past has created land dispute problems between the parties involved (Diamond Development Initiative, 2008, p. 4-14).

The mining sector in Sierra Leone is regulated by the Mines and Minerals (Amendment) Act of 2004, which succeeded the Mines and Minerals Act of 1994. The Mines and Minerals Act, however, does not set out requirements for the granting of industrial-scale mining licenses as distinct from artisanal mining licenses. The Government also passed a Diamond Cutting and Polishing Act in 2007 in an attempt to establish an industry for the local beneficiation of the country's gem-quality diamond. The country's Law Reform Commission drafted comprehensive legislation concerning land and property rights, but this legislation was awaiting Parliament approval. The Government also created Chiefdom Mining Allocation Committees to address problems concerning the access by foreigners to artisanal mining licenses, to assist in the prevention of disputes concerning landholding claims involving mining sites, and to settle mining rights disputes at the community level in lieu of a cadastre system for mining that was in the process of being implemented (Diamond Development Initiative, 2008, p. 6-7, 11, 14; Ministry of Mineral Resources, 2009).

On August 11, 2007, Sierra Leone held nationwide Presidential and Parliamentary elections, and in March 2008, the new Government announced its intention to review all mining contracts in the country with the help of experts from the World Bank (Jalloh, 2008; Krawitz, 2008).

In June 2008, the World Bank approved a $5.1 million grant and a $5.9 million credit for the development of infrastructure projects in Sierra Leone. The assistance was mostly aimed at rehabilitating airport facilities, ports, and roads; supporting institutional and regulatory reforms; and assisting the management of the road, port, and airport sectors (Sheriff, 2008; World Bank, The, 2008).

Production

Output levels for most mineral commodities decreased during the year with the exception of ilmenite and cement, which showed increases of 11.3% and 7.8%, respectively. Bauxite production decreased by 18.4% to 954,000 metric tons (t) in 2008 from about 1.2 million metric tons (Mt) produced in 2007; diamond production decreased by 38.5% to 371,261 carats from a revised 603,623 carats in 2007 mostly owing to a decrease in the demand for diamond exports as a result of the global financial crisis and the cessation of operations at the Koidu Mine; gold production decreased by 7.5% to 196 kilograms (kg); and rutile production decreased by 4.4% to 78,908 t from a revised 82,527 t owing to the collapse of a dredge.

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Structure of the Mineral Industry

Koidu Holdings S.A. (KHSA) (BSG Resources Ltd., 65%, and Magma Diamond Resources Ltd., 35%) operated the Koidu kimberlite mine; Sierra Leone Cement Corp. Ltd. operated the country's sole cement plant; Sierra Mineral Holdings I Ltd. (Vimetco N.V.) operated the Sierra Mineral (SML) bauxite mine; and Sierra Rutile Ltd. (Titanium Resources Group Ltd.) operated the Sierra Rutile Mine. Table 2 is a list of major mineral industry facilities.

Mineral Trade

Exports of diamond by volume decreased by 46% to 371,290 carats compared with exports in 2007; about 50% of these exports were gem-quality diamond. The Bank of Sierra Leone attributed the decrease in diamond exports to the drop in the world market price for rough diamond and to the cessation of operations at the Koidu Mine (Bank of Sierra Leone, 2009, p. 7).

Commodity Review

Metals

Bauxite and Alumina.—In July, Titanium Resources Group Ltd. sold the SML bauxite mine to Netherlands-based Vimetco N.V. for $40.5 million. Vimetco mined bauxite from the Gbonge, the Gondama, the Jenega, the Konta, and the Wunde deposits and operated a wash plant at Gondama with a production capacity of 300 metric tons per hour and a recovery rate of 65%. Resources at SML were estimated to be 31 Mt at a grade of 53% Al_2O_3 and 4% SiO_2. The production capacity of the mine was 1.2 million metric tons per year (Mt/yr) (Titanium Resources Group Ltd., 2008a; 2009, p. 2; Vimetco N.V., 2009, p. 10, 16, 32).

Gold.—Cluff Gold plc acquired 100% interest in the Baomahun gold project, which is located about 180 kilometers (km) east of the capital city of Freetown in Southern Province. On June 25, 2008, the company announced measured and indicated mineral resources at Baomahun to be 8.9 Mt of ore at a grade of 2.9 grams per metric ton (g/t) gold. The company held a 25-year mining lease for the project. More than 22,000 meters of core drilling were completed at Baomahun in 2008. Slope assessments and geotechnical studies were underway and a proposed plant and tailings dam site had been identified. The company planned to conduct a bankable feasibility study by the end of 2009 (Cluff Gold plc, 2008; Swanepoel, 2008).

Axmin Inc. continued to explore for gold at the Komahun gold project, which is located within the Nimini Hill concession. A new resource estimate for Komahun was announced in September. Indicated mineral resources were estimated to be 370,000 t at a grade of 9.1 g/t gold and inferred mineral resources were estimated to be 3.1 Mt at a grade of 4.3 g/t gold. The exploration license was held under a joint-venture agreement with AFCAN Barbados Ltd. (a subsidiary of Eldorado Gold Corp.). Axmin Inc. could increase its ownership in the project to 80% from 60% upon completion of a bankable feasibility study (Axmin Inc., 2008).

Other companies exploring for gold in the country included African Diamonds plc of the United Kingdom, Golden Star Resources Ltd. (GSR) of the United States, and London-based Target Resources plc.

Iron Ore.—African Minerals Ltd. announced the results of a resource estimate conducted by SRK Consulting Ltd. of the United Kingdom for the company's Tonkolili project, which is located in the Sula Mountains Greenstone Belt of Sierra Leone about 190 km from Tagrin Point. Indicated mineral resources at Tonkolili were estimated to be 2.8 billion metric tons (Gt) and inferred mineral resources were estimated to be 1.9 Gt. The resource estimates were based on exploration data available up to December 12, 2008. Previous metallurgical test work carried out on bulk samples of the primary Banded Iron Formation (BIF) at Tonkolili indicated that a concentrate assaying 68% iron or higher was achievable with a silica level in the magnetite concentrate of between 3% and 5%. A hematite-rich lateritic cap overlies the primary BIF, and the company estimated that because of this, there is potential to increase the resource at Tonkolili. Following the results of SRK's assessment, the company planned to expedite a prefeasibility study to assess the economic viability of the project (African Minerals Ltd., 2009).

Titanium and Zirconium.—In July, Titanium Resources Group Ltd. announced that dredge D2, which was used in the mining of rutile at the Sierra Rutile Mine, had capsized into the freshwater lagoon that was being mined. The company's main producing dredge, dredge D1, was unaffected by the incident and was moved into a higher grade mining area. The company planned to rehabilitate dredge D2 but announced that the rehabilitation would not take place until sufficient funding was secured. The estimated time to have the dredge operational again was 2 years. The Sierra Rutile Mine is located in southwestern Sierra Leone near the Imperri Hills, about 30 km from the Atlantic Ocean and 135 km from the capital city of Freetown. In addition to rutile, the mine produced ilmenite and small amounts of zircon (Titanium Resources Group Ltd., 2008b; 2009, p. 2, 5-6, 9).

Industrial Minerals

Diamond.—Sierra Leone's diamond production was mainly from alluvial mining, the majority of which came from the Bo, the Kenema, and the Kono districts along the drainages of the Bafi, the Mano, the Moa, the Sewa, and the Woyie Rivers. About 60% of all mining licenses granted in 2006 were for mining operations in the Kono district. During the 1940s and 1960s, two of the world's largest rough diamonds, the Woyie River Diamond, which weighed 770 carats, and the Star of Sierra Leone, which weighed 968.9 carats, were recovered from the gravels of the Woyie River. The Woyie River flows through the town of Koidu, which is located within the Kono district. Throughout time, the Woyie River's tributaries drained kimberlite pipes and dykes at Koidu, and diamond from these pipes was washed and concentrated in surrounding alluvial deposits. The only kimberlite operation in the country was KHSA's Koidu Kimberlite Project (KKP), which was located within the Tankoro Chiefdom of the Kono district in Eastern Province about 2 km from the district capital of Koidu. KHSA

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held a 25-year mining lease for the project; the lease was valid until 2020. The KKP comprised two kimberlite pipes and several dyke zones. Following the country's 2007 Presidential elections, about 1,000 illegal miners were estimated to have invaded diamond-bearing land that was held under concession by KHSA (Manson, 2007; Diamond Development Initiative, 2008, p. 7; Kamara, 2008; Koidu Holdings S.A., 2008).

In December 2007, more than 400 protesters in the town of Koidu allegedly looted mining equipment and destroyed a generator belonging to KHSA. Protests were reportedly staged by Koidu residents following the inaction of the pertinent authorities concerning resident frustrations over KHSA's noncommitment in fulfilling corporate responsibilities. The company reportedly had agreed to relocate residents to make way for its mining operations, but the slow implementation of the plan and claims by the Tankoro Chiefdom that citizens were coerced into accepting an inequitable surface rent for the use of the land, among other issues, prompted the demonstrations against the company. Following the incidents, the Government ordered the suspension of KHSA's diamond mining operations. The violence in Koidu was believed to have been prompted by the rising unemployment among the Kono district youth and the reduction in force of more than 500 KHSA employees. The Kono district reportedly hosted one of the highest numbers of civil war ex-combatants in the country (Manson, 2007; Awoko Newpaper, 2008, p. 3, 13; Gbenda, 2008; Kamara, 2008).

Mexivada Mining Corp. of Canada through its subsidiary Mexivada Gold and Diamond Mining Company (SL) Ltd. signed a memorandum of understanding with the Gbense Chiefdom of the Kono district for the mining of alluvial diamond at a site near Yarudu in the town of Koidu. Once operating, about 70% of the profits from the project would go to Mexivada, and the remaining 30% of profits was to be shared between the people of the Chiefdom and their local partner, Pink Diamond Exploration Company Ltd. Mexivada's investment in the project was $25,000 (Tacy Ltd., 2008a, b).

United Kingdom-based West African Diamonds plc (WAD) held a 60% interest in a mining lease for a tailings dump that was prospective for gold and diamond and a kimberlite pipe and dyke that were prospective for diamond. During the first quarter of 2008, a processing plant (Plant 11) was commissioned to treat the tailings material. The tailings dump was the result of 23 years of processing diamond and gold-rich material from the Meya, the Moinde, and the Woyie Rivers by Sierra Leone's National Diamond Mining Co., which operated between 1969 and 1992. Kimberlite samples from Pipes 1 and 2 (now owned by KHSA) were also treated at Plant 11 during this period. Preliminary results from the processing of material in 2008 indicated a gold grade of 0.04 g/t gold and a diamond grade of 1.6 carats per hundred metric tons (West African Diamonds plc, 2009, p. 10-11).

Other companies exploring for diamond in the country included the joint venture of Petra Diamonds Ltd. (51%) of South Africa and Stellar Diamonds Ltd. (49%) of Canada, which explored for diamond in the Kono district; Canada-based Cream Minerals Ltd. in joint venture with Casierra Development Fund Inc.; and Target Resources plc of the United Kingdom (Cream Minerals Ltd., 2008; Target Resources plc, 2008; Petra Diamonds Ltd., 2009, p. 54-55).

Mineral Fuels

Petroleum.—Sierra Leone did not produce or refine petroleum and was dependent upon imports for its petroleum requirements.

Outlook

Despite the slowdown in mineral production during 2008, Sierra Leone's economy is likely to continue to depend greatly on revenues from the diamond sector. Although already a world leading producer of rutile, export earnings from the production of this mineral commodity are likely to be hindered in the short run by the temporary shutdown of operations at the Sierra Rutile Mine. The Sierra Rutile Mine, however, is expected to become operational again sometime after 2010. Potential also exists for the country to become a world-class iron ore producer. The Government's plan to review all mining contracts in the country may hinder potential mineral exploration and prospecting activities in the country owing to investor uncertainty concerning the guarantee of an adequate legislative framework that defines mining rights and obligations.

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TABLE 1
SIERRA LEONE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
Bauxite	thousand metric tons	--	--	1,072	1,169	954
Cement		180,460	172,120	234,440	235,830	254,160
Diamond[2, 3]	carats	691,757	668,710	603,566	603,623 r	371,261
Gold, mine output, Au content	kilograms	27	53	71	212	196
Ilmenite, gross weight[4]		--	--	13,819	15,750	17,528
Rutile, gross weight		--	--	73,802	82,527 r	78,908
Salt		827	--	--	--	--

rRevised. -- Zero.
[1]Table includes data available through October 6, 2009.
[2]Source: Kimberley Process Certification Scheme.
[3]About 60% gem quality and 40% industrial quality.
[4]In addition to ilmenite and rutile, the country produced small amounts of zircon.

TABLE 2
SIERRA LEONE: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite		Sierra Mineral Holdings I Ltd. (Vimetco N.V.)	Sierra Mineral Mine, 150 kilometers southeast of Freetown	1,200
Cement		Sierra Leone Cement Corp. Ltd.	Freetown plant	NA
Diamond	thousand carats	Koidu Holdings S.A. (KHSA) (BSG Resources Ltd., 65%, and Magma Diamond Resources Ltd., 35%)	Two kimberlite pipes, 2 kilometers from the district capital of Koidu	120
Titanium, ilmenite		Sierra Rutile Ltd. (Titanium Resources Group Ltd.)	Sierra Rutile Mine, 130 kilometers southeast of Freetown	15
Titanium, rutile concentrate		do.	do.	100

do. Ditto. NA Not available.

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The Mineral Industry of Somalia

By Thomas R. Yager

Somalia, which is an East African country located on the Gulf of Aden and the Indian Ocean, produced small quantities of gemstones, granite, marble, niobium (columbium), salt, sandstone, and tantalum. The mineral industry made a small contribution to Somalia's exports and economy in general. The country also had deposits of feldspar, iron ore, kaolin, limestone, natural gas, quartz, silica sand, tin, and uranium.

Civil war continued in Somalia in 2008. Ethiopian military forces and the Transitional Federal Government engaged in combat with various antigovernment elements in Mogadishu. In northern Somalia, the semiautonomous region of Puntland and the self-declared Republic of Somaliland (which maintains a separate regional governing authority) engaged in armed conflict regarding an unresolved border dispute in January. Maakhir, which was part of the territory disputed by Puntland and Somaliland, declared autonomy from Puntland, Somalia, and Somaliland. Somaliland's declaration of independence in 1991 and Puntland's and Maakhir's declarations of autonomy in 1998 and 2007, respectively, had not been internationally recognized (Human Rights Watch, 2008; McGregor, 2008).

Production

Mineral production data continued to be unavailable because of the lack of a functioning central Government since 1991 and the conflict that pervaded most of the country. In 2006, a dimension stone operation that produced granite, marble, and sandstone started production in Somaliland. In 2008, niobium (columbium) and tantalum mining operations started. The war forced the closure of Somalia's oil refinery and cement plant in 1991 and 1996, respectively.

Structure of the Mineral Industry

Private companies produced granite, marble, niobium (columbium), sandstone, and tantalum. Gemstone and salt mining operations appear to be artisanal and small-scale in nature. The cement plant and refinery were operated by parastatal companies before their closure. The collapse of the central Government in 1991 led to ambiguity concerning mineral rights and ownership of facilities.

Commodity Review

Metals

Niobium (Columbium) and Tantalum.—In August 2008, Green African Development AB (GAD) of Sweden started mining niobium (columbium) and tantalum at Dalow near Berbera. About 120 miners produced at the rate of about 27 metric tons per year of columbite-tantalite. As of the end of 2008, the governing authorities of Somaliland had not awarded a mining license to GAD (Indian Ocean Newsletter, 2009).

Industrial Minerals

Gemstones.—Such gemstones as aquamarine, emerald, red spinel, ruby, sapphire, and tourmaline were produced in Somaliland on a limited scale. Garnet and opal accounted for the largest shares of gemstone production. In 2007, Somagem Mining Company Ltd. started trial mining of emerald at the Simodi deposit. The company also planned to mine gemstones at its Mandheera project, which is located northeast of Hargeisa.

Mineral Fuels

Natural Gas and Petroleum.—In March 2008, the governing authorities of Puntland approved new legislation to enable foreign companies to engage in drilling exploration wells. The Transitional Federal Government of Somalia reached an agreement with the governing authorities of Puntland on petroleum exploration in May; Africa Oil Corp. of Canada and Range Resources Ltd. of Australia received Federal approval to explore in Puntland (Africa Energy Intelligence, 2008a, b).

In December 2008, Africa Oil and Range Resources completed a seismic survey at their Dharoor Valley and Nogal Blocks in Puntland. The companies planned to start exploration drilling at Dharoor Valley in 2009; drilling had not taken place in Somalia since 1992 (Africa Oil Corp., 2009).

In May 2008, the governing authorities of Somaliland awarded exploration licenses to Asante Oil Ltd. of Norway for Blocks SL13 and SL14. Asante planned to start exploration drilling by 2009. Ophir Energy Company Ltd. of South Africa held the Berbera Block; Prime Resources Ltd. of the United Kingdom and Motherland Homes Ltd. of India also held licenses in Somaliland. In October, the governing authorities of Somaliland announced plans to start a new licensing round for natural gas and petroleum exploration blocks (Africa Energy Intelligence, 2008c, d).

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The Mineral Industry of South Africa

By Thomas R. Yager

The Republic of South Africa remained one of the world's leading mining and mineral-processing countries. In 2008, South Africa's estimated share of world platinum production amounted to 77%; kyanite and other materials, 55%; chromium, 45%; palladium, 39%; vermiculite, 39%; vanadium, 38%; zirconium, 30%; manganese, 21%; rutile, 20%; ilmenite, 19%; gold, 11%; fluorspar, 6%; aluminum, 2%; antimony, 2%; iron ore, 2%; nickel, 2%; and phosphate rock, 1%. South Africa also accounted for nearly 5% of the world's polished diamond production by value. The country's estimated share of world reserves of platinum-group metals (PGM) amounted to 89%; hafnium, 46%; zirconium, 27%; vanadium, 23%; manganese, 19%; rutile, 18%; fluorspar, 18%; gold, 13%; phosphate rock, 10%; ilmenite, 9%; and nickel, 5% (Bray, 2009; Carlin, 2009; Corathers, 2009; Gambogi, 2009a, b; George, 2009; Jasinski, 2009; Jorgenson, 2009; Kuck, 2009; Loferski, 2009; Magyar, 2009; Miller, 2009; Papp, 2009; Potter, 2009a, b).

Minerals in the National Economy

The output of the mining industry accounted for 9.5% of the gross domestic product in 2008; crude and processed mineral products accounted for 41% of the value of total exports. About 73% of crude mineral products and 80% of processed mineral products, by value, were exported in 2008. Employment in the mining industry amounted to 518,519 in 2008 compared with 495,150 in 2007. PGM mining accounted for 38.6% of the mining industry's employment; gold, 32.1%; coal, 12.6%; diamond, 3.6%; and other minerals, 13.1% (Mwape and others, 2009, p. 10-12, 14-15).

Government Policies and Programs

The Diamonds Act of 2005 was enacted in early 2006; this legislation was intended to promote domestic cutting and polishing of rough diamond. In February 2008, the State Diamond Trader was established with a mandate to purchase 10% of South Africa's rough diamond production for use in domestic cutting and polishing plants (Mining Review Africa, 2008b; Mwape and others, 2009, p. 3).

The Government's Black Economic Empowerment program required that black ownership of the mining industry reach 15% by 2009 and 26% by 2014. Recent deals to increase black ownership included the acquisition of Namakwa Sands (Pty) Ltd. by Exxaro Resources Ltd. Anglo American Platinum Corp. sold its 22.4% share in Northam Platinum Ltd. to Mvelaphanda Resources Ltd., which increased Mvelaphanda's share in Northam to 63%. Anooraq Resources Corp. planned to purchase a 51% share in Anglo Platinum's Lebowa Mine in November 2008; the deal was postponed until the first quarter of 2009 (Mwape and others, 2009, p. 2; Onstad, 2009).

Production

In 2008, feldspar production increased by about 17%; iron ore, 16%; manganese ore, 14%; mined copper, by 12%; and lead, 11%. The output of mineral pigments decreased by 83%; talc, 64%; slate, 59%; pyrophyllite, 35%; direct-reduced iron (DRI), 31%; ferromanganese, 28%; crude petroleum, silicomanganese, and sodium sulfate, 23% each; kaolin, 22%; refined cobalt, 21%; brick clay and shale, 19% each; andalusite and refined copper, 18% each; mined gold and mined nickel, 16% each; diamond, 15%; fire clay, refined zinc, and vanadium, 14% each; flint clay and refined nickel, 12% each; sulfur and phosphate rock, 11% each; mica, 10%; and refined gold, an estimated 10% (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., July 17, 2009).

Structure of the Mineral Industry

Most of the South African mineral industry was privately owned. The production of diamond and gold, which were produced mostly by artisanal miners in many African countries, was dominated by large-scale producers in South Africa. The leading producer's share of total output varied sharply by commodity; the leading producer of diamond accounted for 93% of national production; iron ore, 69%; manganese ore, 51%; chromite, 43%; and coal, 24%.

Mineral Trade

In 2008, exports of PGM amounted to $9.43 billion; gold, $5.32 billion; coal, $5.13 billion; iron ore, $2.45 billion; manganese ore, $1.89 billion; nickel, $497 million; copper, $183 million; chromite, $154 million; and other crude mineral products, which included diamond, ilmenite, rutile, and zircon, $1.33 billion. Exports of ferrochromium amounted to $3.43 billion; manganese metal and alloys, $1.44 billion; vanadium alloys and other vanadium products, $374 million; silicon metal and alloys, $209 million; and other processed mineral products, which included aluminum, $2.86 billion (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., July 17, 2009).

In 2008, South Africa's imports of industrial minerals and processed industrial mineral products amounted to $1.61 billion; diamond and other gemstones, $176 million; and ferrous metals and products, $116 million (Mwape and others, 2009, p. 16).

Commodity Review

Metals

Aluminum.—South Africa produced primary aluminum from imported alumina. BHP Billiton Ltd. operated the Bayside

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and the Hillside primary aluminum smelters at Richards Bay. In March 2008, BHP Billiton announced plans to reduce production by about 90,000 metric tons (t) because of power supply constraints. The smelters' electricity consumption accounted for 2,150 megawatts (MW) of capacity (BHP Billiton Ltd., 2008, p. 6; 2009, p. 2; Ryan, 2008).

Rio Tinto Group planned to start building a new aluminum smelter at Coega in Eastern Cape Province in 2008 at a cost of $3.25 billion. The smelter was expected to be completed in 2011 with a capacity of 360,000 metric tons per year (t/yr). By 2013, Rio Tinto planned to double the smelter's capacity. In its first stage, the smelter's electricity consumption was expected to account for 670 MW of capacity, and in the second stage, 1,350 MW of capacity. In May, Rio Tinto put development of the smelter on hold (Mining Journal, 2008b; Ryan, 2008).

Chromium.—Xstrata plc of Switzerland and its joint-venture partner Merafe Resources Ltd. operated the Boshoek, the Helena, the Horizon, the Kroondal, the Thorncliffe, and the Waterval Mines, which had a total capacity of 5.57 million metric tons per year (Mt/yr) of chromite. The company's production in South Africa increased to 4.15 million metric tons (Mt) in 2008 from 3.47 Mt in 2007. The Boshoek Mine produced 1.33 Mt in 2008 compared with 602,000 t in 2007. Production at the Helena Mine increased to 434,000 t from 335,000 t (Xstrata plc, 2009, p. 76).

Xstrata and Merafe operated the Boshoek, the Lion, the Lydenburg, the Rustenburg, and the Wonderkop ferrochromium plants. These plants had a total combined capacity of 1.98 Mt/yr. In 2008, output decreased to 1.13 Mt from 1.22 Mt. Production decreased at Rustenburg to 302,000 t in 2008 from 381,000 t in 2007; and at Lydenburg to 283,000 t from 341,000 t (Xstrata plc, 2009, p. 45, 76).

The proposed doubling of the Lion plant's capacity to 720,000 t/yr by the end of 2010 was put on hold because of power supply constraints. In November, Xstrata and Merafe announced plans to shut down temporarily about 500,000 t/yr of ferrochromium capacity; an additional 406,000 t/yr was shut down at the beginning of December. Furnaces at the Boshoek, the Lydenburg, the Rustenburg, and the Wonderkop plants were closed (Ryan's Notes, 2007a, 2008a, c; Xstrata plc, 2009, p. 46).

Samancor Chrome Ltd. (a subsidiary of Kermas Group Ltd. of the United Kingdom) produced about 3.5 Mt/yr from the Eastern Chrome Mines in Mpumalanga Province and the Western Chrome Mines in North West Province. The majority of the company's output was consumed in its ferrochromium plants.

Samancor Chrome operated the Ferrometals plant in Witbank, the Middelburg ferrochrome plant in Middelburg, and the Tubatse ferrochrome plant in Steelpoort. The company planned to increase its capacity to 2.7 Mt/yr from 1.2 Mt/yr between 2011 and 2015. The expansion was expected to take place in three increments of 500,000 t/yr each. In early 2008, Samancor's expansion was reportedly on hold because of power supply constraints. The company reduced production in the fourth quarter of 2008 because of the world economic crisis. In early December, Samancor decided to shut down all mining and smelting operations from mid-December to the end of February 2009 (Mathews, 2007; Metal Bulletin, 2008b; Ryan's Notes, 2008a, b).

Assmang Ltd. [African Rainbow Minerals Ltd. (ARM), 50%, and Assore Ltd., 50%] operated the Dwarsrivier Mine in Mpumalanga. In fiscal year[1] 2008, production increased to 849,000 t from 710,000 t in fiscal year 2007. The Dwarsrivier Mine had an estimated remaining life of 30 years (African Rainbow Minerals Ltd., 2008, p. 3, 46).

Assmang produced ferrochromium at the 290,000-t/yr Machadodorp plant in Mpumalanga Province. In fiscal year 2008, output increased to 270,000 t from 242,000 t in fiscal year 2007. In late October, Assmang announced plans to reduce ferrochromium production by 100,000 t/yr. The company also planned to reduce ore production at Dwarsrivier (African Rainbow Minerals Ltd., 2008, p. 46; Ryan's Notes, 2008b).

ARM and its joint-venture partner MMC Norilsk Nickel of Russia operated the Nkomati chromite mine. In fiscal year 2008, production increased to nearly 1.18 Mt from 631,000 t in fiscal year 2007. Production at Nkomati was expected to be more than 1 Mt of chromite in fiscal year 2009; the life of the mine was estimated to be 18 years. In October 2008, ARM planned to reduce sales of chromite and to continue to produce and stockpile ore (African Rainbow Minerals Ltd., 2008, p. 3, 31; Ryan's Notes, 2008b).

ASA Metals (Pty) Ltd. produced about 360,000 t/yr of chromite from its Dilokong Mine at Burgersfort in Mpumalanga Province. The company planned to increase the capacity of its beneficiation plant to 1.2 Mt/yr and to sink two new mine shafts; capacity at the ferrochromium plant in Limpopo was expected to increase to 360,000 t/yr from 120,000 t/yr. In the fourth quarter of 2008, ASA Metals was operating at about 75% of capacity; further cutbacks in production were expected (Mining Journal, 2008b; Ryan's Notes, 2008c).

Hernic Ferrochrome (Pty) Ltd. (a subsidiary of Mitsubishi Corp. of Japan) operated a ferrochromium plant with a capacity of 420,000 t/yr. The company mined chromite at the Maroelabult open pit mine from 1996 to 2000; development of a new underground mine at Bokfontein was planned in mid-2008. The new mine was expected to have a capacity of 1.5 Mt/yr. Hernic cut ferrochromium production in the second half of 2008; the company was producing at a rate of between 96,000 and 108,000 t/yr in early December (Ryan's Notes, 2008e; Hernic Ferrochrome (Pty) Ltd., undated).

International Ferro Metals Ltd. (IFM) opened its new Buffelsfontein chromite mine and ferrochromium plant in North West Province in 2007. In fiscal year 2008, IFM produced 205,607 t of ferrochromium. The company planned to expand chromite capacity to 1.8 Mt/yr by November 2009; the ferrochromium plant's capacity was to be increased to 665,000 t/yr from 267,000 t/yr. In November, IFM announced that it was deferring expansion plans and reducing production to 144,000 t/yr; production was shut down temporarily in December (Ryan's Notes, 2008d-f).

In early 2008, Tata Steel Ltd. of India opened a new ferrochromium plant at Richards Bay with a capacity of 120,000 t/yr. Tata produced ferrochromium with a chromium content of 47% to 48%; the plant reportedly had difficulty in handling higher-grade material (Ryan's Notes, 2008d).

[1]Fiscal years run from the end of June in the named calendar year through the end of June in the following year unless otherwise specified.

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Gold.—The long-term decline in the country's gold output continued in 2008, with national gold mine production decreasing to 212,744 kilograms (kg) from 252,598 kg in 2007 (table 1). Difficulties in mining at greater depths, lower ore grades, power supply constraints, and safety-related stoppages contributed to the decline.

AngloGold Ashanti Ltd. operated the Great Noligwa, the Kopanang, the Moab Khotsong, and the Tau Lekoa Mines in the West Wits area near Carletonville; and the Mponeng, the Savuka, and the Tau Tona Mines in the Vaal River area near Klerksdorp. AngloGold Ashanti's gold production decreased to 65,283 kg in 2008 from 72,429 kg in 2007 (AngloGold Ashanti Ltd., 2009, p. 98).

Most of the decline was attributable to the Great Noligwa Mine, where output decreased to 10,264 kg in 2008 from 15,023 kg in 2007; the Tau Tona Mine, where output decreased to 9,766 kg from 12,721 kg; and the Kopanang Mine, where production decreased to 11,259 kg from 13,001 kg. Production increased slightly at the Mponeng Mine in 2008. Decreases in production were attributable to power supply constraints and seismic activity (AngloGold Ashanti Ltd., 2009, p. 44, 46, 48).

In 2009, AngloGold Ashanti expected to produce a total of between 56,000 and 59,000 kg of gold. The Moab Khotsong Mine produced 5,965 kg of gold in 2008 compared with 2,084 kg in 2007; AngloGold Ashanti planned to increase the output to 10,000 kg in 2009 and 13,600 kg by 2011. At the Kopanang Mine, production was expected to increase to about 12,400 kg in 2009 from 11,244 kg in 2008. Production was expected to decrease at the Great Noligwa, the Mponeng, the Tau Lekoa, and the Tau Tona Mines (AngloGold Ashanti Ltd., 2009, p. 41, 45, 47-49, 52-53).

Harmony Gold Mining Co. Ltd. produced gold at numerous mines; the company's output was 48,227 kg in fiscal year 2008 compared with 54,340 kg in fiscal year 2007. Decreased production was attributable to numerous factors that included decreased ore grades, difficult geologic conditions, flooding, power supply constraints, and seismic events. In fiscal year 2008, production decreased at the Bambanani, the Doornkop, the Elandsrand, the Masimong, the Target, and the Tshepong Mines. Harmony planned to increase its South African gold production to more than 60,000 kilograms per year (kg/yr) by fiscal year 2012. The company planned to increase production at the Doornkop Mine to 10,800 kg/yr by July 2012 from 1,373 kg/yr in fiscal year 2008. The Phakisa Mine started production in September 2008; full output of 7,900 kg/yr was expected by June 2011. At the Elandsrand Mine, production was likely to increase to 11,500 kg/yr by June 2012 from 4,934 kg/yr in fiscal year 2008 (Harmony Gold Mining Company Ltd., 2008, p. 22, 24-29, 33, 35, 37-38).

Gold Fields Ltd. of South Africa produced gold at the Beatrix, the Driefontein, the Kloof, and the South Deep Mines. Production at the Driefontein Mine decreased to 25,807 kg in 2008 from 31,466 kg in 2007; at the Kloof Mine, to 20,263 kg from a revised 28,482 kg, at the Beatrix Mine, to 12,696 kg from 15,022 kg; and at the South Deep Mine, to 5,124 kg from 8,654 kg. In 2008, ore grades were lower at the Beatrix, the Driefontein, and the Kloof Mines than in 2007 (Gold Fields Ltd., 2009b).

Gold Fields planned to increase its total production to about 75,000 kg/yr by the fourth quarter of 2009. The Driefontein and the Kloof Mines were expected to produce more than 25,000 kg/yr each. Gold Fields planned to increase production at South Deep to about 10,000 kg/yr by the first quarter of 2010 and to 25,000 kg/yr by the end of 2014 (Gold Fields Ltd., 2009a, p. 9, 15).

In 2008, gold production by DRDGold Ltd. decreased to 8,476 kg from 10,113 kg in 2007. Output at the Blyvooruitzicht Mine was 4,117 kg in 2008; the Crown Mine, 2,612 kg; and the East Rand Proprietary Mine (ERPM), 1,747 kg. Ore grades decreased at Blyvooruitzicht and ERPM in the second half of 2008 compared with the same period in 2007. In the fourth quarter of 2008, DRDGold and its joint-venture partner Mintails Ltd. of Australia reopened the Ergo tailings treatment plant, which was purchased from AngloGold Ashanti. The companies planned to produce 2,300 kg/yr at Ergo starting in 2009 (Conradie, 2009; DRDGold Ltd., 2009).

Pamodzi Gold Ltd. operated the Orkney and the President Steyn Mines. The company produced at a rate of about 7,000 kg/yr in the second quarter of 2008; production was limited by safety issues and equipment problems. Pamodzi planned to increase production to 13,000 kg/yr by the fourth quarter of 2009 (Mathews, 2008a).

Simmer and Jack Mines Ltd. acquired the Buffelsfontein Mine from DRDGold in 2005. The company planned to produce about 3,400 kg of gold at Buffelsfontein in its 2009 fiscal year (which ran from the beginning of April to the end of March). Production was likely to reach 5,200 kg in fiscal year 2011, 7,100 kg in fiscal year 2013, and 7,500 kg in fiscal year 2015. Starting in fiscal year 2018, gold production at the Buffelsfontein Mine was expected to exceed 9,500 kg/yr and to reach 12,500 kg/yr in fiscal year 2028. Simmer and Jack also planned to produce an average of 1,400 kg/yr of gold at the Transvaal Gold Mining Estate project from fiscal year 2009 to fiscal year 2021 (Simmer and Jack Mines Ltd., 2009).

First Uranium Corp. of Canada (a subsidiary of Simmer and Jack) planned to start mining at the Ezulwini Mine by March 2009; gold production was expected to reach 7,800 kg in fiscal year 2011, 8,400 kg in fiscal year 2013, and 10,300 kg in fiscal year 2015. From fiscal year 2017 to fiscal year 2025, production at Ezulwini was planned to be more than 12,500 kg/yr. First Uranium also planned to recover an average of 3,700 kg/yr of gold at the Buffelsfontein tailings project between fiscal year 2010 and fiscal year 2022 (Simmer and Jack Mines Ltd., 2009).

Great Basin Gold Ltd. (GBG) was engaged in construction of the Burnstone underground gold mine in the Mpumalanga Province in 2008. The company planned to start mining at Burnstone in January 2010; average production was likely to be 7,900 kg/yr during the 14-year life of the mine. Capital costs of the project were estimated to be $238 million.

Gold One International Ltd. planned to open its new Modder East underground mine starting in 2009. The company planned to produce 620 kg of gold in 2009 and to increase production to 4,400 kg in 2010 and 5,600 kg in 2011. Contained gold resources were estimated to be 114,000 kg, of which 42,000 kg was reserves (Andrews, 2009).

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Central Rand Gold Ltd. planned to reopen underground mines in the Central Rand gold field, where production was shut down in the mid-1970s. The company originally planned to start gold production at a rate of 3,100 kg/yr in 2009. By 2012, Central Rand expected to increase production to more than 31,000 kg/yr. Central Rand revised its mining plan to 620 kg in 2009 and about 1,200 kg/yr for the first 7 years of mine life because high costs rendered most of the company's resources subeconomic (Ryan, 2009).

Rand Refinery Ltd. in Germiston (AngloGold Ashanti, 53%; Gold Fields, 33%; DRDGold, 10%; Avgold Ltd., 2%; Western Areas Ltd., 2%) refined most of the gold mined in South Africa; the company also refined gold that was mined in other African countries. The remainder of South Africa's refined gold was produced by small gold recycling companies (AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 27-28).

Iron and Steel.—ArcelorMittal South Africa Ltd. accounted for most of South Africa's production of crude steel at its Newcastle, Saldanha, Vanderbijlpark, and Vereeniging plants. In 2008, ArcelorMittal's crude steel production decreased to 5.77 Mt from 6.38 Mt in 2007 because of power supply constraints, repairs at Saldanha, and declining steel demand. Most of the company's production was consumed domestically, especially in the building and construction industry (ArcelorMittal South Africa Ltd., 2009, p. 3, 25, 31-33).

New DRI furnaces with a capacity of 350,000 t/yr were expected to be installed at Vanderbijlpark in the first half of 2009; the furnaces would increase crude steel capacity by 220,000 t/yr. ArcelorMittal's remaining South African expansion plans were on hold because of the worldwide economic crisis (ArcelorMittal South Africa Ltd., 2009, p. 27, 32).

Highveld Steel and Vanadium Corp. Ltd. of South Africa (Evraz Group S.A. of Luxembourg, 79%) operated a steel mill at Witbank; the company's production of crude steel amounted to 796,000 t in 2008. Columbus Stainless (Pty) and Scaw Metals (a subsidiary of Anglo American plc) also produced crude steel (Evraz Group S.A., 2009).

Iron Ore.—Assmang, Highveld, and Kumba Iron Ore Ltd. of South Africa mined iron ore. Kumba operated the Sishen Mine in Northern Cape Province and the Thabazimbi Mine in Limpopo Province. In 2008, production from the Sishen Mine increased to 34 Mt from 29.7 Mt in 2007; about 4.7 Mt of the increase was attributable to the installation of the new jig plant. Output increased in 2008 in spite of a late start at the jig plant and technical problems during the rampup of production. At the Thabazimbi Mine, production remained nearly unchanged at 2.7 Mt in 2008 (Kumba Iron Ore Ltd., 2009, p. 21-22, 26).

Kumba planned to increase production at the jig plant to its full capacity of 13 Mt/yr of iron ore in the fourth quarter of 2009. The company was also considering a further expansion of the Sishen Mine's capacity by 10 Mt/yr by 2014. Capital expenditures for the expansion were estimated to be nearly $1.2 billion. The project remained unapproved at the end of 2008 (Kumba Iron Ore Ltd., 2009, p. 28, 48).

Kumba approved the Sishen South project in July 2008; the project is located 80 kilometers south of the Sishen Mine. Sishen South was expected to start production in 2012 and to reach full capacity of 9 Mt/yr of iron ore in 2013. The life of the project was estimated to be 20 years. The estimated capital costs of the project were $1.1 billion (Kumba Iron Ore Ltd., 2009, p. 30).

In 2007, Kumba extended the life of the Thabazimbi Mine until 2014. The company planned to complete a prefeasibility study of extending the life of the mine until at least 2034 by discovering additional resources and increasing production to 3.4 Mt/yr. The study was expected to be completed in 2010 (Kumba Iron Ore Ltd., 2009, p. 26).

Assmang produced iron ore at the Beeshoek Mine in Northern Cape, which had a rated capacity of 6 Mt/yr. In fiscal year 2008, production decreased to 4.49 Mt from 6.68 Mt in fiscal year 2007. Output was expected to continue to decrease over the remaining 7-year life of the mine (African Rainbow Minerals Ltd., 2008, p. 3, 38, 42).

Assmang opened the new Khumani Mine in fiscal year 2008; production amounted to 1.85 Mt. In fiscal year 2009, Assmang planned to increase the production capacity to 10 Mt/yr from 8.4 Mt/yr and to increase iron ore output to 7.2 Mt. The company also planned to complete a feasibility study of increasing production capacity to between 16 and 20 Mt/yr in the second quarter of 2009. Depending on favorable results of the study, the expansion could be completed in 2013. Most of Khumani's output was expected to be exported. The remaining life of the mine was estimated to be 30 years (African Rainbow Minerals Ltd., 2008, p. 3, 42, 44).

Lead and Zinc.—Anglo American operated the Black Mountain lead-zinc-copper mine near Aggeneys in Northern Cape Province. In 2008, production amounted to 27,900 t of zinc and 47,000 t of lead from 1.2 Mt of ore milled compared with 28,300 t of zinc and 41,900 t of lead from 1.1 Mt of ore milled in 2007 (Anglo American plc, 2009, p. 165).

In October 2008, Minero Zinc (Pty) Ltd. purchased the Pering Mine from BHP Billiton. Minero planned to reopen the Pering Mine, which was shut down in 2003. Production was expected to start at a rate of 16,000 t/yr of zinc and 1,500 t/yr of lead in 2009 and to increase to 50,000 t/yr of zinc and 6,000 t/yr of lead (Africa Mining Intelligence, 2008).

Zinc Corp. of South Africa Ltd. (a subsidiary of Exxaro Resources Ltd.) operated South Africa's only zinc refinery at Springs. In 2008, production decreased to 87,000 t of refined zinc from 101,000 t in 2007 because of power supply constraints and repairs to equipment (Exxaro Resources Ltd., 2009, p. 41-42).

Manganese.—Assmang produced manganese ore at the Gloria and the Nchwaning Mines. Capacity at Nchwaning was 3 Mt/yr, and at Gloria, 600,000 t/yr. In fiscal year 2008, production at these mines increased to 3.15 Mt from 2.85 Mt in fiscal year 2007. Assmang planned to increase production at Gloria and Nchwaning in fiscal year 2009. The company also planned to increase capacity at Nchwaning to 5 Mt/yr. The estimated remaining life of the Gloria and the Nchwaning Mines was 30 years (African Rainbow Minerals Ltd., 2008, p. 3, 40, 45).

Assmang operated the Cato Ridge ferromanganese plant in Kwa-Zulu Natal, which had a rated capacity of 300,000 t/yr. In fiscal year 2008, output decreased to 261,000 t from 347,000 t in fiscal year 2007 because of an explosion at one of the plant's furnaces in February (African Rainbow Minerals Ltd., 2008, p. 45).

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Samancor Manganese (Pty) Ltd. (BHP Billiton, 60%, and Anglo American, 40%) operated the Mamatwan open pit mine and the Wessels underground mine near Hotazel in Northern Cape Province. In 2008, Samancor's production of manganese ore increased to 3.44 Mt from 2.54 Mt in 2007. The company's ferromanganese and silicomanganese plant at Meyerton was South Africa's leading producer of manganese alloys. In 2008, output of manganese alloys at Meyerton was 494,000 t compared with 469,000 t in 2007. In December, Samancor announced plans to reduce manganese ore and alloy production in 2009; the company planned to rebuild furnaces at Meyerton (BHP Billiton Ltd., 2008, p. 4; 2009, p. 4; Metal Bulletin, 2008a).

Renova was engaged in a joint-venture project with domestic companies Chancellor House and Pitsoe ya Setshaba to develop the Kalahari manganese ore deposit. Construction of a new mine was completed in 2008; the production capacity was planned to be between 1.5 Mt/yr and 2 Mt/yr of manganese ore. Mining operations were limited because of a lack of power and transportation infrastructure (Ryan's Notes, 2007b).

ArcelorMittal was engaged in a joint venture with Kalagadi Manganese (Pty) Ltd. (Kalahari Resources Ltd., 80%) and Government-owned Industrial Development Corp. (IDC) to develop Kalagadi's manganese resources. Arcelor and Kalahari (which was a Black Economic Empowerment company) planned to start production at a new underground mine at Hotazel in 2010. Output was expected to be 3 Mt/yr of manganese ore. The life of the mine was estimated to be more than 20 years. The companies also planned to build a new ferromanganese plant at Coega with a capacity of 320,000 t/yr by 2010; the plant was expected to consume nearly 30% of the mine's sintered output. By 2015, capacity at the ferromanganese plant was likely to double (Engineering & Mining Journal, 2008; Mining Journal, 2008b).

Nickel.—Most of South Africa's nickel mine production was a coproduct of PGM mining. Nickel output decreased in 2008 because of reduced domestic demand for stainless steel. Anglo Platinum produced 15,500 t of refined nickel at Rustenburg Base Metal Refiners in 2008 compared with 19,200 t in 2007. About 13,900 t was attributable to the company's PGM mining operations compared with 17,300 t in 2007 (Anglo American Platinum Corp., 2009, p. 106).

ARM produced 5,136 t of nickel at the Nkomati Mine in fiscal year 2008 compared with 4,418 t in fiscal year 2007. The company planned to increase mine production to 20,500 t/yr of nickel by fiscal year 2011-12. The life of the mine was expected to be 18 years (African Rainbow Minerals Ltd., 2008, p. 3, 23, 31).

Platinum-Group Metals.—In 2008, Anglo Platinum produced 140,900 kg of refined platinum-group metals (PGM) compared with 148,700 kg in 2007. About 114,900 kg was attributable to the company's mining operations in 2008 compared with 129,200 kg in 2007. Platinum produced from Anglo Platinum's mining operations amounted to 60,552 kg; palladium, 33,315 kg; rhodium, 7,571 kg; and other PGM, about 13,400 kg (Anglo American Platinum Corp., 2009, p. 106).

Output decreased at the Amandelbult, the Bafokeng-Rasimone (a joint venture with Royal Bafokeng Resources), the Lebowa, the Mototolo (a joint venture with XK Platinum Partnership), the Rustenburg, and the Union Mines in 2008. Production decreased for numerous reasons, including excessive rainfall, labor disputes, power outages, safety stoppages, and shortages of skilled labor. At Amandelbult, production decreased to 26,068 kg of PGM in 2008 from 33,340 kg in 2007; and at Union, to 17,925 kg from 18,930 kg. At the Kroondal (a joint venture with Aquarius Platinum Ltd.), the Mogalakwana, and the Twickenham Mines, production increased. Anglo Platinum planned to maintain production at about 75,000 kg/yr of refined platinum, which included toll refining (Anglo American Platinum Corp., 2009, p. 56, 62, 107-116, 119).

Anooraq planned to purchase a 51% share in the Lebowa Mine from Anglo Platinum in the first quarter of 2009. The mine produced nearly 4,600 kg of PGM in 2008. Anooraq planned to increase production to more than 13,000 kg/yr by 2013 and to nearly 18,000 kg/yr by 2020. Resources at Lebowa were estimated to be 6,200 t of contained PGM (Onstad, 2009).

Impala Platinum Holdings Ltd. (Implats) operated the Impala Mines near Rustenburg in North West Province and the Marula Mine in Limpopo Province. In fiscal year 2008, production of refined PGM at Impala was nearly unchanged at 57,265 kg, and platinum, at 32,472 kg. Implats planned to maintain production between 31,000 kg/yr and 34,000 kg/yr of platinum through at least 2018. The company completed the capacity expansion of the Precious Metals Refinery to 71,500 kg/yr of refined platinum from about 62,000 kg/yr in 2008. Implats planned to complete a subsequent increase in the refinery's capacity to 87,000 kg/yr of refined platinum by 2011 (Impala Platinum Holdings Ltd., 2008, p. 52-55).

In fiscal year 2008, platinum output at Marula increased to 2,190 kg from 2,028 kg in fiscal year 2007; production was constrained by labor disputes and the closures of shafts for safety reasons. Implats planned to reach Marula's full capacity of 4,000 kg/yr of platinum by fiscal year 2010. Implats planned to start an expansion at Marula in fiscal year 2009. Production from the expansion project was expected to start in fiscal year 2014. By fiscal year 2016, platinum production was likely to reach 7,600 kg/yr (Impala Platinum Holdings Ltd., 2008, p. 56-58).

In April 2008, Implats was awarded the mining rights for the Leeuwkop project near Brits. Depending upon approval of the project and reliable power supplies, Implats could start construction of a new mine in early 2009. Production was expected to start in fiscal year 2013; the mine was likely to reach its full capacity of between 5,000 kg/yr and 5,600 kg/yr of platinum by fiscal year 2015 (Impala Platinum Holdings Ltd., 2008, p. 69).

Implats also operated a refinery northeast of Johannesburg; production at this plant was from purchased concentrates and toll refining. In fiscal year 2008, output decreased to 56,077 kg of PGM from 61,768 kg in fiscal year 2007 (Impala Platinum Holdings Ltd., 2008, p. 68).

Lonmin plc of the United Kingdom mined PGM at its Marikana operations east of Rustenburg in North West Province and at the Limpopo and the Pandora Mines. From September 2007 to September 2008, these mines produced a total of 22,772 kg of platinum compared with 27,055 kg in the previous 12 months. Total production of PGM decreased to 42,818 kg from 50,931 kg. The Limpopo Mine was placed

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on care-and-maintenance status in late 2008; surface mining operations at Marikana were also shut down. Lonmin planned to produce about 22,600 kg of platinum in its fiscal year 2009; plans to increase production to nearly 44,000 kg/yr by 2012 were under review (Lonmin plc, 2008; Mining Review Africa, 2009c).

ARM and Implats operated the Two Rivers Mine in Mpumalanga Province; production increased to 6,423 kg of PGM in fiscal year 2008 from 5,726 kg in fiscal year 2007. The Two Rivers Mine was expected to reach its full capacity of 6,800 kg/yr of PGM in fiscal year 2009. ARM and Anglo Platinum produced 9,167 kg of PGM at Modikwa in fiscal year 2008 that included 4,164 kg of platinum and 4,039 kg of palladium. Output was expected to increase to nearly 10,300 kg/yr starting in fiscal year 2009. The remaining life of the Modikwa and the Two Rivers Mines was estimated to be 30 and 20 years, respectively. ARM also planned to produce 3,400 kg/yr of PGM with the expansion of the Nkomati nickel mine; output amounted to 1,269 kg in fiscal year 2008 (African Rainbow Minerals Ltd., 2008, p. 3, 22, 27-28, 31).

Aquarius operated the Marikana Mine. In 2008, production of PGM at Marikana was nearly unchanged at 4,167 kg. The Everest Platinum Mine produced 3,935 kg of PGM in 2008 compared with 5,493 kg in 2007. Aquarius planned to produce 6,200 kg/yr of PGM at Everest until 2017. The mine, however, was shut down for safety reasons in early December 2008. The closure of the mine was expected to last for at least 6 months. Aquarius also planned to increase production at joint-venture tailings retreatment projects to 1,300 kg/yr of PGM (Aquarius Platinum Ltd., 2009, p. 2, 9; Conradie, 2009; Mining Review Africa, 2009a).

In 2008, Xstrata produced 4,510 kg of PGM at the Elandsfontein Mine compared with 435 kg in 2007. The company planned to increase production to about 9,000 kg/yr by 2012. The life of the Elandsfontein Mine was estimated to be about 50 years (Xstrata plc, 2009, p. 48, 76).

Eastern Platinum Ltd. (Eastplats) of Canada produced PGM at the Crocodile River Mine; planned production for 2008 was 4,000 kg. By 2010, Eastplats planned to increase production at Crocodile River to 6,800 kg/yr of PGM. The company also planned to start production at the new Spitskop Mine in 2009; output was expected to be nearly 1,300 kg of PGM in 2010, 4,400 kg in 2011, and 6,400 kg/yr starting in 2012. Eastplats planned to start production at the new Mareesburg Mine in 2009 and to reach the full capacity of nearly 3,300 kg/yr of PGM in 2012. The planned expansions after 2009 depended on securing additional power supplies. In December, Eastplats put its expansion plans on hold (Eastern Platinum Ltd., 2008).

Ridge Mining plc of the United Kingdom and Imbani Platinum (Pty) Ltd. were engaged in a joint venture to produce PGM from the Blue Ridge project. The companies planned to produce 3,900 kg/yr of PGM from the new Blue Ridge Mine starting in the third quarter of 2009 (Conradie, 2009).

Ridge Mining and its joint-venture partners Anglo Platinum and IDC were considering the development of a new mine at the Sheba's Ridge deposit. The mine was expected to produce 23,000 t/yr of nickel, 11,000 t/yr of copper, 7,600 kg/yr of palladium, 2,600 kg/yr of platinum, and 620 kg/yr of gold. The estimated capital cost of the project was $972 million. ARM, IDC, Implats, and Ridge were considering a joint venture to conduct a feasibility study of a new smelter; existing PGM smelter capacity was insufficient to handle the planned output from Sheba's Ridge. Development of the mine also depended on negotiations with Eskom concerning power supplies (Mining Journal, 2008a).

In October 2008, Platinum Australia Pty Ltd. (PLA) of Australia started underground operations at its new Smokey Hills Mine. PLA planned to reach the full capacity of about 3,000 kg/yr of PGM by January 2010. PGMs from Smokey Hills were toll smelted and refined at Rustenburg. The capital cost of the project was about $45 million (Avery, 2009).

In 2009, Platmin Ltd. of Canada planned to produce between 3,900 and 4,700 kg of PGM at its new Pilanesberg Mine on the western limb of the Bushveld Complex. Platmin planned to increase production to the full capacity of 7,800 kg/yr in 2010. Resources were estimated to be 350,000 kg of contained PGM, of which nearly 140,000 kg was reserves. The life of the mine was expected to be 17 years (Mining Review Africa, 2009b).

Platmin was also considering the development of the Mphahlele project, which could produce an additional 7,800 kg/yr of PGM, and the Grootboom project, which could produce about 2,700 kg/yr. The company planned to make a decision on the development of Grootboom in 2009 and Mphahlele in 2010. Depending on Platmin's decision, production could start at Grootboom by the third quarter of 2009. Full production at Grootboom and Mphahlele could be achieved by 2012. The life of the Mphahlele and the Grootboom Mines was estimated to be 30 and 15 years, respectively (Mining Journal, 2008b; Mining Review Africa, 2009b).

In March 2008, Wesizwe Platinum Ltd. completed its prefeasibility study on mining at the Frischgewaagd-Ledig deposit. Wesizwe revised the timeline for the project in late 2008 because of the worldwide economic crisis. The company planned to start preliminary construction activities in late 2009 and to begin production in 2014. The full capacity of 10,900 kg/yr of PGM was expected to be reached by 2018. The life of the mine at full production was estimated to be 35 years (Wesizwe Platinum Ltd., 2009, p. 9, 12).

Silicon.—Grupo Ferroatlantica produced silicon metal at Polokwane; the company's output increased to 51,800 t in 2008 from 50,300 t in 2007 in spite of power supply constraints in the first quarter. Ferrosilicon was produced by Grupo Ferroatlantica and Silicon Technology (Pty) Ltd.; production decreased slightly in 2008 (Lerner, 2008).

Titanium and Zirconium.—Anglo American mined ilmenite, rutile, and zircon at its Namakwa Sands project on South Africa's western coast. Ilmenite production at Namakwa Sands increased to 315,000 t in 2008 from 300,000 t in 2007; rutile, to 27,000 t from 24,000 t; and zircon, to 130,000 t from 115,000 t. Exxaro purchased Namakwa Sands from Anglo American in October 2008 (Exxaro Resources Ltd., 2009, p. 37, 39).

In 2008, Exxaro produced 229,000 t of ilmenite from the KZN Sands Mine in KwaZulu Natal Province compared with 367,000 t in 2007. Rutile production increased to 19,000 t from 17,000 t, and zircon production remained unchanged at 34,000 t. Exxaro delayed the start of construction on the Fairbreeze Mine

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until the second half of 2009 as it updated the feasibility study. Depending on the results of the study, production was expected to start at Fairbreeze in the first half of 2011 (Exxaro Resources Ltd., 2009, p. 37, 44).

Mineral Commodities Ltd. (MRC) of Australia was engaged in a joint venture with the Xolobeni Community Empowerment Co. (XolCo) to develop the Xolobeni mineral sands project in Eastern Cape Province. The Government awarded mining rights to MRC and XolCo in August 2008. Output was expected to start in 2009 at a rate of 250,000 t/yr of ilmenite, 19,000 t/yr of rutile, and 17,000 t/yr of zircon. XolCo also planned to build a plant that would produce 137,000 t/yr of titanium dioxide and 75,000 t/yr of pig iron from raw materials mined at Xolobeni. Capital costs for the project were estimated to be $200 million. The life of the mine was expected to be 22 years (Mining Review Africa, 2007).

Vanadium.—Evraz Group produced vanadium from titaniferous magnetite at the Krokodilkraal and the Mapochs Mines, which were operated by Highveld and Vametco Minerals Corp., respectively. In 2008, production of vanadium in ferrovanadium, vanadium pentoxide (V_2O_5), vanadium slag, and vanadium chemicals at Krokodilkraal and Mapochs amounted to nearly 15,800 t. In late August, Evraz sold Highveld's vanadium operations to Vanchem Vanadium Products Pty Ltd., which was a subsidiary of Duferco Investment Partners of Switzerland (Evraz Group S.A., 2009).

Xstrata produced V_2O_5 at the Rhovan Mine in Brits; output decreased to 7,530 t of V_2O_5 in 2008 from 8,558 t in 2007. Ferrovanadium production at Rhovan decreased to 3,622 t in 2008 from 4,280 t in 2007. Reduced production was attributable to power supply constraints (Xstrata plc, 2009, p. 47, 76).

Industrial Minerals

Cement.—Domestic sales of cementitous products decreased to 13.3 Mt from 13.7 Mt in 2007. Decreased demand for cement in the residential construction sector more than offset increased demand in road building and the new Kusile power station in Mpumalanga Province. The cement industry accounted for 78% of South Africa's dolomite and limestone demand (Naidoo and Ramane, 2009).

Pretoria Portland Cement Co. (Pty) Ltd. (PPC) was South Africa's leading cement producer. In 2008, PPC increased the capacity of its Dwaalboom plant to 1.25 Mt/yr; the company also planned to increase the capacity of its Riebeeck plant to 1.35 Mt/yr by 2012. Sephaku Cement planned to build a new cement plant in North West Province with a capacity of 2.1 Mt/yr. The plant was expected to be completed by mid-2011 at an estimated cost of $360 million (Naidoo and Ramane, 2009).

Diamond.—De Beers Group accounted for most of South Africa's rough diamond production. In 2008, the company's output decreased to 12 million carats from 15 million carats in 2007. At Venetia, production decreased to 7.5 million carats from 9.08 million carats; at Kimberley, to 913,000 carats from 1.63 million carats; and at Namaqualand, to 310,000 carats from 767,000 carats. The Cullinan Mine produced 540,000 carats before its sale in 2008. The Oaks Mine was depleted and shut down. De Beers completed an upgrade of the Finsch Mine treatment plant (De Beers Group, 2009, p. 12, 31).

De Beers reopened the Voorspoed Mine in Free State Province in 2008; output amounted to 128,000 carats. The company planned to mine 8.3 million carats during the estimated 12- to 16-year life of the mine; production was expected to reach 900,000 carats per year in 2010 (De Beers Group, 2009, p. 12, 31; Janse, 2009).

Petra Diamonds Ltd. produced diamond from the Helam Mine in North West Province, the Sedibeng Mine in Northern Cape Province, and the Star Mine in Free State Province. In 2008, Petra produced 610,179 carats of diamond, of which 455,567 carats was attributable to the Cullinan Mine after its purchase from De Beers. About 50,000 carats was mined from alluvial deposits by Bonaparte Diamond Mines NL, Firestone Diamonds, Lonrho plc, Namakwa Diamonds Ltd., Rockwell Diamonds Inc., and other producers. The average value of Rockwell's diamonds was $1,600 per carat (Janse, 2009).

Between 120,000 and 140,000 carats per year of diamond was estimated to be cut and polished in South Africa. African Romance produced cut diamond at a rate of about 25,000 carats per year compared with its capacity of 40,000 carats per year. The domestic cutting and polishing industry was limited by rough diamond prices that increased in 2007 and the first half of 2008 as polished prices remained nearly unchanged (Mining Review Africa, 2008b).

Fluorspar and Rare-Earth Elements.—National fluorspar production increased in 2008 because of increased output from the Buffalo and the Witkop Mines, which were owned by Sallies Ltd. In fiscal year 2008, production at Witkop increased by 17%. In October 2008, Sallies shut down the Buffalo Mine because of phosphorous contamination of the mine's acid-grade fluorspar. Production was not economic because of the relatively low prices that Sallies received from the few producers that had the equipment to process high-phosphorous fluorspar. Recovering rare-earth elements from the Buffalo Mine's tailings was also subeconomic because of the complex production process (Mathews, 2008b).

Kyanite and Related Materials.—South Africa was the world's leading producer of andalusite, which was mined by Andalusite Resources (Pty) Ltd. and Samrec Pty. Ltd. (a subsidiary of Imerys Group of France). In 2008, production decreased because of lower export demand for andalusite as a refractory in steel production. Samrec reopened the Annesley Mine in 2008. By the beginning of 2010, Samrec planned to complete a debottlenecking program at its Krugersport and Rhino Mines that would increase capacity by 30,000 t/yr. Development of a new andalusite mine at Segorong was on hold in late 2008 because of procedural issues (Industrial Minerals, 2008; Nevondo, 2009).

Mineral Fuels and Related Materials

Coal.—South Africa's coal production amounted to 252.2 Mt in 2008, of which 250 Mt was bituminous. Domestic coal consumption was 197.1 Mt, and exports, 57.9 Mt. In 2008, electric power generation accounted for 64% of South Africa's coal consumption; synthetic fuels made from coal, 22%; and other industries, 14% (Ikaneng, 2009).

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Anglo American's coal production remained nearly unchanged at 59.4 Mt in 2008. Production at Kriel decreased to 10.3 Mt from 11.2 Mt, and at Goedehoop, to 7.45 Mt from 8.46 Mt. At Kleinkopje, output increased to 4.55 Mt from 3.49 Mt. The Mafube Mine, which was a joint venture between Anglo American and Exxaro, reached its full capacity of 5.4 Mt/yr in the second quarter of 2008. Production started at the MacWest Mine in 2008; the mine was expected to reach its full capacity of 2.7 Mt/yr in the first quarter of 2009. Anglo American also planned to complete the Zondagsfontein project in the fourth quarter of 2010, which was likely to produce 6.6 Mt/yr of thermal coal. The life of the Zondagsfontein Mine was estimated to be 20 years (Mining Review Africa, 2008a; Anglo American plc, 2009, p. 19, 162).

Other projects under consideration by Anglo American included the Heidelberg opencast mine, which could produce 0.9 Mt/yr starting in 2009; the Elders opencast mine, 6.4 Mt/yr starting in 2011; the Elders underground mine, 3.2 Mt/yr starting in 2012; the Heidelberg underground mine, 4.2 Mt/yr starting in 2014; and the New Largo Mine, 14.7 Mt/yr starting in 2015. The New Largo project had resources of 700 Mt; the life of the mine was estimated to be more than 40 years. The development of New Largo depended on the construction of Eskom's new 4,800-MW Kusile power station. These projects remained unapproved by the Board of Directors at the end of 2008. Depending upon the approval of these projects, Anglo American's coal production could reach 90 Mt in 2015 (Mining Review Africa, 2008a; Anglo American plc, 2009, p. 19).

Exxaro operated the Grootegeluk and the Tshikondeni Mines in Limpopo Province and the Arnot, the Leeuwpan, the Malta, the New Clydesdale, and the North Block Complex Mines in Mpumalanga Province. Production from the company's mines amounted to about 44.8 Mt in 2008 compared with 41.3 Mt in 2007. The Grootegeluk Mine produced at a rate of about 16 Mt/yr, and the Matla Mine, more than 13 Mt/yr. Output at the Arnot Mine increased to 4.87 Mt in 2008 from 3.7 Mt, and at the North Block Complex, to 3.28 Mt from 2.28 Mt. The Inyanda Mine near Witbank started production in 2008 (Exxaro Resources Ltd., 2009, p. 8).

In August 2008, Exxaro completed a feasibility study of the expansion of the Grootegeluk Mine by 14.6 Mt/yr. Construction on the expanded mine was planned to start in 2010 and to be completed by 2015. Production at Grootegeluk was expected to reach 36 Mt in 2015; the expansion was planned to take place in stages to match the capacity expansions of the Medupi power station from the end of 2011 to 2014. Exxaro also planned to produce 1 Mt/yr at the new Eerstelingsfontein Mine near Belfast starting in the second quarter of 2009 (Mining Review Africa, 2008c; Exxaro Resources Ltd., 2009, p. 43).

In fiscal year 2008, Sasol Ltd. of South Africa decreased its coal production to 42.8 Mt from 43.3 Mt in fiscal year 2007. At the Secunda Mining Complex, output decreased to 41.1 Mt from 41.9 Mt. Increased production from the Syferfontein Mine was more than offset by decreased production from the Bosjesspruit, the Middelbult, and the Twistdraai Mines. Sasol consumed 40.1 Mt of coal in the production of synthetic fuels and exported 3.4 Mt of coal, primarily to Europe. Sasol planned to build the new Thubelisha Mine to replace the Twistdraai Mine; production was expected to start in 2012 (Sasol Ltd., 2008, p. 43, 110; Ikaneng, 2009).

BHP Billiton Energy Coal South Africa Ltd. (formerly Ingwe Coal Corp. Ltd.) produced coal at the Douglas, the Khutala, the Klipspruit, and the Middelburg Mines in Mpumalanga Province. In 2008, Ingwe produced 39.1 Mt of coal compared with 48.4 Mt in 2007. Sales to local utilities amounted to 28.1 Mt in 2008; exports, 12.4 Mt; and sales to other South African customers, 1.2 Mt. BHP Billiton planned to increase run-of-mine production at the Klipspruit Mine to 8 Mt/yr from 4.8 Mt/yr (BHP Billiton Ltd., 2008, 2009, p. 4; Ikaneng, 2009).

Xstrata operated nine coal mines at Breyten, Ermelo, and Witbank. In 2008, production at the company's mines decreased to 20.2 Mt from 21.4 Mt in 2007. Output at the iMpunzi Division decreased to 3.37 Mt from 6.76 Mt. Production at the Tweefontein Division increased to 6.18 Mt in 2008 from 5.11 Mt in 2007, and at the Goedgevonden Mine, to 2.91 Mt from 1.69 Mt (Xstrata plc, 2009, p. 77).

ARM and Xstrata were engaged in a joint venture to increase output at the Goedgevonden Mine to 6.7 Mt/yr. About 3.5 Mt/yr of coal was expected to be consumed domestically and about 3.2 Mt/yr would be exported. ARM and Xstrata planned to reach full capacity at Goedgevonden in 2011. The life of the mine was expected to be 33 years. Capital costs were estimated to be about $390 million (African Rainbow Minerals Ltd., 2008, p. 54).

Coal of Africa Ltd. started production at the Mooiplaats Mine in October 2008; production was expected to reach between 3.5 Mt/yr and 4 Mt/yr of run-of-mine coal by mid-2010. The company also planned to produce 1 Mt/yr at the new Holfontein Mine in the second half of 2009; output was expected to reach 5 Mt/yr by 2011 (Ikaneng, 2009).

Uranium.—AngloGold Ashanti mined uranium as a coproduct of gold at the Great Noligwa, the Kopanang, and the Tau Lekoa Mines. In 2008, the company's production of uranium oxide (U_3O_8) amounted to 580 t compared with 558 t in 2007. AngloGold Ashanti planned to increase its output to about 900 t/yr in 2013; the increase would be attributable to increased uranium recovery from re-treating uranium-bearing slimes (Mining Journal, 2008b; AngloGold Ashanti Ltd., 2009, p. 281).

Uranium One started production at the Dominion Reefs underground uranium mine in 2007. The company planned to produce about 900 t of U_3O_8 in 2008; production plans subsequently were scaled back to about 270 t. In late 2008, the mine was forced to shut down because of power supply constraints; overestimates of reserves, grades, and recovery rates; and underestimates of costs (Mining Journal, 2008b).

First Uranium planned to start uranium production at the Buffelsfontein tailings project and the Ezulwini Mine in fiscal year 2010. Production at the Buffelsfontein tailings project was expected to be nearly 390 t of U_3O_8 in fiscal year 2010 and to reach a peak of 980 t in fiscal year 2012. From fiscal year 2015 to fiscal year 2023, First Uranium planned to produce more than 550 t/yr of U_3O_8 at the Buffelsfontein tailings project. The company planned to produce about 160 t of U_3O_8 at Ezulwini in fiscal year 2010, 330 t in fiscal year 2012, and 630 t/yr from fiscal year 2017 to fiscal year 2024 (Simmer and Jack Mines Ltd., 2009).

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Outlook

Numerous producers planned new mines and plants and capacity expansions of existing operations for andalusite, cement, coal, gold, ilmenite, iron ore, manganese ore, nickel, PGM, rutile, uranium, and zircon. The power supply constraints experienced by many mining and mineral processing operations in early 2008 were inconsequential owing to the decrease in demand for power resulting from the worldwide economic crisis. In the event of economic recovery, power shortages could again constrain mining and mineral processing expansions until 2012 when Exkom planned to complete new coal-fired power stations that would have a combined capacity of 9,600 MW. Expansions and new mines and plants before 2012 were less likely to take place in power-intensive sectors, such as ferrochromium, and depended on worldwide economic recovery. Increases in coal exports also depended upon increased capacity on the rail lines between the coal fields in Mpumalanga Province and Richards Bay and at the Richards Bay Coal Terminal.

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TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum metal, primary		866,074	846,213	895,000	899,000	811,000
Antimony concentrate:						
Gross weight		NA r	NA r	NA r	NA r	NA
Sb content		4,967	5,979	4,362	3,354	3,370
Chromium, gross weight:						
44% to 48% chromic oxide	thousand metric tons	2,888	2,394	1,755	2,122	2,135
Less than 44% chromic oxide	do.	4,789	5,100	5,663	7,543	7,547
Total	do.	7,677	7,494	7,418	9,665	9,682
Cobalt:						
Mine output, Co content e		460	400	400	400	400
Refinery output		309	268	267	307 r	244
Copper:						
Mine (company output), Cu content		85,700 r	88,600 r	89,700 r	97,000 r	109,000
Metal:						
Smelter		112,025 r	92,000 r	100,000	105,000 r	95,000
Refined, primary		91,295	99,439	104,052	113,166	92,972
Gold:						
Mine	kilograms	337,223	294,671	272,128	252,598	212,744
Refined	do.	445,300	451,533	427,313	400,000 e	360,000 e
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	39,322	39,542	41,326	42,083	48,983
Fe content (62%-65%)	do.	24,800	24,900	26,000	26,500	30,800
Metal:						
Pig iron	do.	6,011	6,130	6,159	5,358	5,350
Direct-reduced iron	do.	1,633	1,781	1,754	1,736 r	1,190
Ferroalloys, electric arc furnace:						
Chromium ferroalloys	do.	3,032	2,802	3,030	3,552 r	3,269
Ferromanganese	do.	612	571	656	699	503
Ferrosilicon	do.	141	127	149	140 r	135
Ferrovanadium e	do.	20	19	18	19	19
Silicomanganese e	do.	334	231	247	302	233
Silicon metal	do.	51	54	53	50	52
Other	do.	NA r	NA r	NA r	NA r	NA
Total e	do.	4,190 r	3,800 r	4,150 r	4,760 r	4,210
Steel:						
Crude	do.	9,500	9,494	9,718	9,098 r	8,550
Stainless		718	658	725	657	613
Lead:						
Concentrate, Pb content		37,485	42,159	48,273	41,857	46,440
Refined, secondary		64,100	66,000	67,000	70,000 e	70,000 e
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand metric tons	1,988	2,467	1,452	1,742	712
45% to 48% manganese	do.	372	454	1,812	1,755	2,897
40% to 45% manganese	do.	1,041	935	895	961	1,192
30% to 40% manganese	do.	864	743	1,042	1,523	1,996
Total	do.	4,265	4,599	5,201	5,981	6,797
Chemical, 35% to 65% manganese dioxide	do.	17	12	12	14	9
Grand total	do.	4,282	4,611	5,213	5,995	6,806
Metal, electrolytic e	do.	40	44 [2]	30	26	26
Nickel:						
Mine output, concentrate, Ni content		39,851	42,392	41,800	37,917	31,675
Metal, electrolytic		39,900	42,400 e	41,800	34,400	30,200

See footnotes at end of table.

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TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS—Continued						
Platinum-group metals:						
Iridium	kilograms	5,769	6,280	6,172	7,211	6,415
Platinum	do.	153,239	163,711	168,125	160,940	146,141
Palladium	do.	76,403	82,961	86,265	83,643	75,537
Rhodium	do.	16,294	20,224	19,633	21,056	19,348
Ruthenium	do.	24,696	29,805	27,333	31,182	28,236
Total	do.	276,401	302,981	307,528	304,032	275,677
Silver, mine	do.	71,600	87,874	86,951	68,919 r	75,199
Titanium:[e]						
Ilmenite concentrate	thousand metric tons	1,900	1,900	1,900	1,900	1,900
Rutile concentrate	do.	110	115	123	123	123
Total	do.	2,010	2,020	2,020	2,020	2,020
Titaniferous slag	do.	1,020	1,020	1,230	1,230	1,230
Uranium, U_3O_8 content		887	795	639	619	654
Vanadium, vanadium metal content		23,302	22,604	23,780	23,486	20,295
Zinc:						
Concentrate:						
Gross weight		NA r	NA r	NA r	NA r	NA
Zn content		32,001	32,112	34,444	30,859	29,002
Metal, smelter, primary		104,000	102,000	90,000	101,000	87,000
Zirconium concentrate (baddeleyite and zircon)[e]		368,000	376,000	398,000	398,000	398,000
INDUSTRIAL MINERALS						
Andalusite		234,625	228,265	221,209	264,645	216,667
Cementitious products:						
Cement, finished product, sales	thousand metric tons	10,297	11,464	12,657	13,650	13,323
Granulated slag, fly ash, and others, sales	do.	1,439	1,511	1,600	1,666	1,396
Total	do.	11,736	12,975	14,257	15,316	14,719
Clays:						
Attapulgite		20,419	34,340	49,225	68,377	69,876
Bentonite		55,859	139,833	32,878	45,778	44,067
Fire clay		133,258	171,773	157,087	161,493	138,100
Flint clay, raw and calcined		53,367	36,607	34,413	53,974	47,290
Kaolin		81,901	59,356	51,602	50,839	39,506
Brick clay, local sales	thousand metric tons	9,523	11,237	11,131	12,017 r	9,763
Diamond, natural:						
Gem[e]	thousand carats	5,800	6,400	6,100	6,100	5,200
Industrial[e]	do.	8,500	9,400	9,050	9,150	7,700
Total	do.	14,295	15,776	15,153	15,250	12,901
Feldspar		53,721	57,534	76,722	90,185	105,815
Fluorspar:						
Acid-grade[e]		250,000	250,000	240,000	268,000	282,000
Metallurgical-grade[e]		15,000	16,000	16,000	17,000	17,000
Total		265,000	266,000	256,000	285,000	299,000
Gypsum, crude		524,000	547,581	554,020	627,377	571,343
Industrial or glass sand (silica)	thousand metric tons	2,249	2,671	3,234	3,385 r	3,544
Lime	do.	1,738	1,417	1,583	1,599	1,563
Magnesite, crude		65,900	54,800	73,300	80,700	83,900
Mica, scrap and ground		285	924	828	437	393
Nitrogen, N content of ammonia[e]		459,100 [2]	460,000	460,000	460,000	460,000
Perlite[e]		400	400	400	400	400

See footnotes at end of table.

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TABLE 1—Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS—Continued						
Phosphate rock:						
Gross weight	thousand metric tons	2,735	2,577	2,629	2,556	2,287
Phosphorus pentoxide content	do.	1,070	1,000	1,020	1,000	890
Pigments, mineral, natural:						
Ochers		360	382	372	20	39
Oxides		152	128	218	212	--
Total		512	510	590	232	39
Salt		332,673	399,087	464,909	411,511	415,996
Sodium sulfate, natural		56,267	55,184	43,303	50,000	38,717
Stone, n.e.s.:[3]						
Dimension:						
Granite and norite		548,600	607,500	497,600	564,100	538,100
Slate		47,500	52,312	33,154	22,876	9,281
Crushed and broken:						
Limestone and dolomite	thousand metric tons	22,031	24,813	27,366	23,941	23,481
Shale:						
For cement	do.	357	501	533	498	418
Other	do.	918 r	1,106 r	1,010 r	1,031 r	817
Total	do.	1,275 r	1,607 r	1,543 r	1,529 r	1,235
Aggregate and sand, n.e.s.	do.	44,437	49,970	58,519	63,873 r	61,369
Sulfur:						
S content of pyrite	do.	165	133	68	71	61
Byproduct:						
Metallurgy	do.	180	220	231	236	187
Petroleum	do.	288	422	343	335	323
Total	do.	633	776	643	642	571
Talc and related materials:						
Talc		8,141	8,469	10,966	14,281	5,145
Pyrophyllite (wonderstone)		28,987	60,267	74,886	123,573	80,704
Vermiculite		196,893	209,801	197,765	198,526 r	199,764
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand metric tons	1,247	1,640	1,584	2,349	2,207
Bituminous	do.	241,500	243,300	243,198	245,317	250,006
Total	do.	242,747	244,940	244,782	247,666	252,213
Natural gas	million cubic meters	1,916	2,060	1,795	1,800 e	1,800 e
Petroleum:[4]						
Crude	thousand 42-gallon barrels	6,769	7,277	4,441	2,559	1,976
Refinery products:						
Liquefied petroleum gases	do.	3,538	3,445	3,793	3,399 r	3,400 e
Gasoline	do.	71,166	67,029	67,711	67,182 r	67,000 e
Jet fuel	do.	14,331	14,751	15,300	13,386 r	13,000 e
Kerosene	do.	4,893	4,777	4,824	4,715 r	4,700 e
Distillate fuel oil	do.	53,272	68,639	73,653	46,394 r	46,000 e
Residual fuel oil	do.	27,919	33,566	32,674	27,426 r	27,000 e
Other, includes lubricants and greases[e]	do.	17,000	17,000	17,000	17,000	17,000
Total[e, 5]	do.	192,000	209,000	215,000	180,000 r	178,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available. -- Zero.
[1]Table includes data available through March 31, 2010.
[2]Reported figure.
[3]Not elsewhere specified.
[4]In addition, Sasol Ltd. produced about 67 million barrels per year of synthetic liquid petroleum fuels from coal.
[5]Excludes refinery fuel and losses.

Source: Mineral Economics Directorate, South Africa Department of Minerals and Energy.

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TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		BHP Billiton Ltd.	Hillside smelter at Richards Bay	700.
Do.		do.	Bayside smelter at Richards Bay	180.
Andalusite		Samrec Pty. Ltd. (Imerys, 100%)	Rhino Mine near Thabazimbi	120.
Do.		do.	Annesley Mine at Penge[2]	75.
Do.		do.	Havercroft Mine at Penge	60.
Do.		do.	Krugerspost Mine, near Lydenburg	50.
Do.		Andalusite Resources (Pty) Ltd. [African Mineral Trading and Exploration (Pty) Ltd.]	Maroeloesfontein, near Thabazimbi, Northern Province	30.
Antimony	metric tons	Consolidated Murchison Ltd. (Metorex Pty. Ltd., 100%)	Consolidated Murchison Mine near Gravelotte	7,000 antimony in concentrate.
Cement		Pretoria Portland Cement Co. (Pty) Ltd. (Barloworld Trust Co. Ltd., 68%)	De Hoek, Dwaalboom, Hercules, Jupiter, Port Elizabeth, Riebeeck, and Slurry plants	6,800.
Do.		Alpha Ltd. [AfriSam Consortium (Pty) Ltd., 48.5%]	Dudfield and Ulco plants	3,700.
Do.		Lafarge South Africa Ltd. (Lafarge S.A.)	Lichtenburg plant in North West Province	2,700.
Do.		Natal Portland Cement Co. (Pty) Ltd. (Cimentos de Portugal SGPS, S.A., 98%)	Simumu plant	1,340.
Chromite		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Boshoek Mine at Boshoek	1,344.
Do.		do.	Kroondal Mine at Rustenburg	1,320.
Do.		do.	Thorncliffe Mine at Steelpoort	1,320.
Do.		do.	Helena Mine at Steelpoort	960.
Do.		do.	Waterval Mine	480.
Do.		do.	Horizon Mine at Pilansberg	144.
Do.		Samancor Chrome Ltd. (Kermas Group Ltd., 100%)	Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province[2]	2,000.
Do.		do.	Western Chrome Mines in Northern Province[2]	1,800.
Do.		International Ferro Metals Ltd.	Buffelsfontein Mine[2]	1,320.
Do.		Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and MMC Norilsk Nickel, 50%)	Nkomati Chrome Mine in Mpumalanga Province	1,000.
Do.		Assmang Ltd. (African Rainbow Minerals Ltd., 50%, and Assore Ltd., 50%)	Dwarsrivier Mine in Mpumalanga Province	880.[e]
Do.		Bayer (Pty) Ltd.	Rustenburg Chrome Mine	450.
Do.		Dilokong Chrome Mine (Pty) Ltd. [ASA Metals (Pty) Ltd., 100%]	Dilokong Mine, near Burgersfort in Mpumalanga Province	360.[e]
Do.		National Manganese Mines (Pty) Ltd.	Buffelsfontein Mine at Mooinooi	180.
Coal		Anglo Coal Ltd. (Anglo American plc, 100%)	Goedehoop, Greenside, Isibonelo, Kleinkopje, Kriel, Landau, Mafube, New Denmark, New Vaal and Nooitgedacht Mines	60,000.[e]
Do.		Exxaro Resources Ltd. (BEE Holdco, 52.3%)	Grootegeluk Mine in Limpopo Province	18,600.
Do.		do.	Matla Mine in Mpumalanga Province	14,000.
Do.		do.	Arnot Mine in Mpumalanga Province	5,000.
Do.		do.	North Block Mine in Mpumalanga Province	3,000.
Do.		do.	Leeuwpan Mine in Mpumalanga Province	2,500.
Do.		do.	Inyanda Mine	1,500.
Do.		do.	New Clydesdale Mine in Mpumalanga Province	1,400.
Do.		do.	Tshikondeni Mine in Limpopo Province	414.
Do.		Sasol Ltd.	Twistdraai Mine	9,600.
Do.		do.	Syferfontein Mine	8,600.
Do.		do.	Middelbult Mine	8,600.
Do.		do.	Brandspruit Mine	8,300.
Do.		do.	Bosjesspruit Mine	8,100.
Do.		do.	Mooikraal Mine	1,800.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal—Continued		BHP Billiton Energy Coal South Africa Ltd., 84%, and Xstrata plc, 16%	Middelburg Mine	17,000 bituminous.
Do.		BHP Billiton Energy Coal South Africa Ltd.	Khutala Underground Mine	15,100 bituminous.
Do.		BHP Billiton Energy Coal South Africa Ltd., 84%, and Xstrata plc, 16%	Douglas Mine	8,500 bituminous.
Do.		BHP Billiton Energy Coal South Africa Ltd.	Klipspruit Mine	3,600 bituminous.
Do.		Xstrata plc, 74%	Goedgevonden Mine at Witbank	6,700.
Do.		Xstrata plc, 79.8%	Tweefontein Division (Boschmans, South Witbank, Waterpan, and Witcons Mines) at Witbank	5,100.
Do.		do.	iMpunzi Division (Phoenix and Tavistock Mines) at Witbank	5,100.
Do.		do.	Southstock Division at Witbank	4,800.
Do.		do.	Mpumalanga Division (Spitzkop and Tselentis Mines) at Breyten and Ermelo	3,300.
Do.		Optimum Coal Holdings (Pty) Ltd	Optimum Open Pit Mine	13,500 bituminous.
Do.		do.	Koornfontein Mines	5,200 bituminous.
Do.		Shanduka Coal (Pty) Ltd. [Glencore International AG, 70%, and Shanduka Resources (Pty) Ltd., 30%]	Bankfontein, Graspan, Lakeside, Leeuwfontein, and Townlands Mines	13,000.
Do.		Coal of Africa Ltd.	Mooiplaats Mine	6,000.
Do.		Kangra Group Pty. Ltd. [Shanduka Resources (Pty) Ltd., 40%]	Savmore Mine	3,000.[e]
Do.		Stuart Coal Group	Stuart Colliery	3,000.[e]
Do.		Total Coal SA (Pty) Ltd.	Forzando North and Forzando South Mines	1,800.[e]
Do.		do.	Dorsfontein Mine	700.[e]
Copper		Palabora Mining Co. Ltd. (Rio Tinto Ltd., 57%, and Anglo American plc, 29%)	Palabora Mines at Phalaborwa	80 copper in concentrate.
Do.		do.	Smelter at Phalaborwa	130 anodes.
Do.		do.	Refinery at Phalaborwa	130 cathodes.
Do.		Anglo American Platinum Corp. Ltd. (Anglo American plc, 74.1%)	Amandebult, Rustenburg, and Union sections; and Bafokeng Rasimone, Lebowa, Modikwa, Potgietersrust, and Western Limb Mines	13[e] mine.
Do.		do.	Rustenburg Base Metal Refiners	12 refined.[e]
Do.		Black Mountain Mineral Development Co. (Pty) Ltd. (Anglo American plc, 74%)	Black Mountain Mine near Aggeneys in Northern Cape Province	6 copper in concentrate.
Do.		Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%)	do.	NA.
Diamond	thousand carats	De Beers Consolidated Mines Ltd. (Anglo American plc, 29%)	Venetia Mine in Northern Province	7,500.
Do.	do.	do.	Finsch Mine, 100 kilometers west of Kimberley	2,800.
Do.	do.	do.	Kimberley Surface Mines, Kimberley	1,500.
Do.	do.	do.	Namaqualand Mine near Kleinzee	1,200.
Do.	do.	do.	Voorspoed Mine	900.
Do.	do.	do.	South Africa Sea Areas	240.
Do.	do.	Petra Diamonds Ltd.	Cullinan Mine	1,800.
Do.	do.	do.	Helam, Sedibeng, and Star Mines	175.
Do.	do.	do.	Koffiefontein Mine in Free State Province	120.
Do.	do.	do.	Kimberley Underground Mines, Kimberley	100.
Do.	do.	Trans Hex Group Ltd.	Baken, Bloeddrif, Reuning, and Saxendrift Mines	140.[e]
Fluorspar		Witkop Fluorspar Mine (Pty) Ltd. (subsidiary of Sallies Ltd.)	Witkop Mine, 250 kilometers west of Johannesburg	180.
Do.		do.	Buffalo Mine at Mookgopong	60.
Do.		Vergenoeg Mining Corp. (Pty) Ltd. [Metorex Pty. Ltd., 70%]	Vergenoeg Mine, 75 kilometers north of Pretoria	120.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold:				
Mine		AngloGold Ashanti Ltd. (Anglo American plc, 41.8%)	Vaal River operations: Kopanang Mine	5,000 ore.
Do.	kilograms	do.	do.	36,000 gold.
Do.		do.	Great Noligwa Mine	2,700 ore.
Do.	kilograms	do.	do.	20,000 gold.
Do.		do.	Tau Lekoa Mine	5,000 ore.
Do.	kilograms	do.	do.	18,100 gold.
Do.		do.	Moab Khotsong Mine	1,200 ore.
Do.	kilograms	do.	do.	9,500 gold.
Do.		do.	West Wits operations: Tau Tona Mine	3,100 ore.
Do.	kilograms	do.	do.	30,000 gold.
Do.		do.	Savuka Mine	3,000 ore.
Do.	kilograms	do.	do.	20,000 gold.
Do.		do.	Mponeng Mine	1,900 ore.
Do.	kilograms	do.	do.	18,000 gold.
Do.		Gold Fields Ltd.	Kloof Mine	3,960 ore.
Do.	kilograms	do.	do.	30,000 gold.
Do.		do.	Driefontein Mine	6,660 ore.
Do.	kilograms	do.	do.	32,000 gold.
Do.		do.	Beatrix Mine	4,920 ore.
Do.	kilograms	do.	do.	23,000 gold.
Do.		Western Areas Ltd. (JCI Gold, 50%, and Gold Fields Ltd., 50%)	South Deep Mine	2,600 ore.
Do.	kilograms	do.	do.	12,000 gold.
Do.		Harmony Gold Mining Co. Ltd.	Randfontein Mine	6,000 ore.
Do.	kilograms	do.	do.	31,000 gold.
Do.		do.	Free State operations	5,020 ore.
Do.	kilograms	do.	do.	26,400 gold.
Do.		Freegold Joint Venture (Harmony Gold Mining Co. Ltd., 50%, and African Rainbow Minerals Ltd., 50%)	Freegold operations	5,040 ore.
Do.	kilograms	do.	do.	15,000 gold.
Do.		Harmony Gold Mining Co. Ltd.	Elandsrand Mines	2,220 ore.
Do.	kilograms	do.	do.	13,300 gold.
Do.		do.	Evander operations	2,400 ore.
Do.	kilograms	do.	do.	11,600 gold.
Do.		do.	Target Mine	1,260 ore.
Do.	kilograms	do.	do.	5,400 gold.
Do.		do.	Kalgold Mine	1,620 ore.
Do.	kilograms	do.	do.	1,800 gold.
Do.		DRDGold Ltd.	Blyvooruitzicht and Doornfontein section	4,800 ore.
Do.	kilograms	do.	do.	4,800 gold.
Do.		do.	Crown Mine	11,760 ore.
Do.	kilograms	do.	do.	4,400 gold.
Do.		do.	East Rand Proprietary Mine	2,200 ore.
Do.	kilograms	do.	do.	2,700 gold.
Do.		Pamodzi Gold Ltd.	President Steyn Gold Mines in Free State Province	1,200 ore.
Do.	kilograms	do.	do.	6,000 gold.
Do.		do.	Orkney Mine	NA.
Do.	do.	Barberton Mines Ltd. [Metorex Ltd., 54%, and Shanduka Resources (Pty) Ltd., 26%]	Eastern Transvaal Consolidated Division (Fairview, New Consort, and Sheba Mines)	3,200.[e]
Refined	metric tons	Rand Refinery Ltd. (AngloGold Ashanti Ltd., 53%, and Gold Fields Ltd., 33%)	Germiston, Gauteng Province	1,200.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel:				
Iron ore		Kumba Iron Ore Ltd.	Sishen Mine at Sishen in Northern Cape Province	42,000.
Do.		do.	Thabazimbi Mine at Thabazimbi	2,700.
Do.		Assmang Ltd.	Khumani Mine	8,400.
Do.		do.	Beeshoek Mine near Postmasburg	6,000.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Ervaz Group S.A., 79%)	Mapochs Mine at Roossenekal, 60 kilometers west of Lydenburg	2,450.
Do.		Xstrata plc	Rhovan Mine at Brits	400.
Do.		Vametco Minerals Corp. (Ervaz Group S.A., 81%)	Krokodilkraal Mine and plant near Brits	180.
Ferroalloys		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Wonderkop	553 ferrochromium.
Do.		do.	Rustenburg	430 ferrochromium.
Do.		Xstrata plc, 69.6%, and Merafe Resources Ltd., 30.4%	Lydenburg	396 ferrochromium.
Do.		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Lion plant at Steelpoort	360 ferrochromium.
Do.		do.	Boshoek	240 ferrochromium.
Do.		Samancor Chrome Division (Kermas Group Ltd., 100%)	Plants at Middelburg, Steelpoort, and Witbank[2]	1,200 ferrochromium.
Do.		Hernic Ferrochrome (Pty) Ltd. (Mitsubishi Corp., 51%)	Plant at Brits	420 ferrochromium.
Do.		Assmang Ltd.	Machadodorp plant in Mpumalanga Province	290 ferrochromium.
Do.		International Ferro Metals Ltd.	Plant in North West Province[2]	267 ferrochromium.
Do.		ASA Metals (Pty) Ltd. (Sinosteel, 60%, and Limpopo Economic Development Enterprise, 40%)	Plant near Pietersburg, Northern Province	120 ferrochromium.
Do.		Tata Steel Ltd.	Richards Bay	120 ferrochromium.
Do.		Samancor Manganese (Pty) Ltd. (BHP Billiton Ltd., 60%, and Anglo American plc, 40%)	Plant at Meyerton	370 ferromanganese; 120 silicomanganese.
Do.		Assmang Ltd.	Cato Ridge plant in KwaZulu Natal Province	300 ferromanganese.
Do.		Advalloy (Pty) Ltd. [Samancor Manganese (Pty) Ltd., 100%]	Furnace at Samancor's Meyerton plant	82 ferromanganese.
Do.		Renova Group	Plant at Witbank	48 ferromanganese
Do.		do.	do.	170 silicomanganese.
Do.		Silicon Technology Pty Ltd.	NA	55 ferrosilicon.
Do.		Grupo Ferroatlantica	Rand Carbide plant	55 ferrosilicon.
Do.	metric tons	Vanchem Vanadium Products (Pty) Ltd.	Plant at Witbank	12,500 ferrovanadium.
Do.	do.	Xstrata plc	Rhovan plant at Brits	6,000 ferrovanadium.
Do.	do.	Vametco Minerals Corp.	Smelter near Brits	4,800 ferrovanadium.
Steel		ArcelorMittal South Africa Ltd.	Vanderbijlpark plant	4,400 crude steel.
Do.		do.	Newcastle plant	1,800 crude steel.
Do.		do.	Saldanha plant	1,200 crude steel.
Do.		do.	Vereeniging plant	400 crude steel.
Do.		Highveld Steel and Vanadium Corp. Ltd.	Witbank	1,000 iron; 1,000 crude steel.
Do.		Columbus Stainless (Pty) Ltd. (Acerinox SA, 76%)	Stainless steel plant at Middelburg	750 crude steel.
Do.		Scaw Metals Division (Anglo Operations Ltd.)	Germiston plant, Johannesburg	600 crude steel.
Do.		Davsteel Division (Cape Gate Pty. Ltd.)	Vanderbijlpark plant, Gauteng	480 crude steel; 480 billet.
Do.		Cape Town Iron & Steel Works (Pty) Ltd.	Kuilsrivier plant, Cape Town	250 crude steel; 250 billet.
Do.		Duferco Steel Processing Ltd.	Cold-rolled slab steel plant at Saldanha Bay	240 rolled steel.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lead		Black Mountain Mineral Development Co. (Pty) Ltd.	Black Mountain Mine near Aggeneys in Northern Cape Province	54 lead in concentrate.
Lime		PPC Lime Ltd (subsidiary of Pretoria Portland Cement Company Ltd.)	Plant at Lime Acres	1,200.
Do.		Idwala Lime (Idwala Industrial Holdings)	Plant at Daniëlskuil	1,000.
Do.		Inca Lime (Pty) Ltd. [subsidiary of Inca Mining (Pty) Ltd.]	Plant at Immerpan, Limpopo Province	100.
Manganese		Assmang Ltd.	Nchwaning Mine near Black Rock	3,000 ore.
Do.		do.	Gloria Mine near Black Rock	600 ore.
Do.		Samancor Manganese (Pty) Ltd.	Mamatwan and Wessels Mines near Hotazel in Northern Cape Province	3,400 ore.
Do.		Renova Group	Kalahari Mine	NA.
Do.		Metmin (Metorex Pty. Ltd., 100%)	Open pit mine in North West Province	24 manganese dioxide.
Do.		Manganese Metal Co. Pty. Ltd. [Samancor Manganese (Pty) Ltd., 51%]	Electrolytic plant at Nelspruit	27 manganese metal.
Nickel		Anglo American Platinum Corp. Ltd.	Amandebult, Rustenburg, and Union sections; and Bafokeng Rasimone, Lebowa, Modikwa, Potgietersrust, and Western Limb Mines	24 mine.[e]
Do.		do.	Rustenburg Base Metal Refiners	22 refined.[e]
Do.		Impala Platinum Ltd.	Impala Mines	8 mine.[e]
Do.		do.	Impala Refining Services	10 refined.[e]
Do.		do.	Base Metals Refinery	14 refined.[e]
Do.		Lonmin plc	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) near Rustenburg and Limpopo Mine	5 mine.[e]
Do.		do.	Base Metals Refinery	5 refined.[e]
Do.		Nkomati Joint Venture	Nkomati Mine in Mpumalanga Province	5 mine.
Nitrogen, ammonia		Sasol Ltd.	Plants at Sasolburg and Secunda	660.
Petroleum:				
Crude	thousand 42-gallon barrels	Petroleum Oil and Gas Corporation of South Africa, 55%, and Pioneer Natural Resources Co., 45%	Pioneer offshore field	21,900.
Do.	do.	Petroleum Oil and Gas Corporation of South Africa	Oribi field 140 kilometers southwest offshore from Mossel Bay	9,100.
Do.	do.	do.	Oryx field	4,400.
Refined	do.	Shell and BP Refineries Pty. Ltd. (Shell SA Energy, 50%, and BP Southern Africa, 50%)	Sapref refinery in Durban	61,900.
Do.	do.	Engen Ltd. (62%)	Engen refinery in Durban	43,463.
Do.	do.	National Petroleum Refiners of South Africa Pty. Ltd. (Sasol Ltd., 63.6%)	Natref refinery in Sasolburg	32,042.
Do.	do.	Caltex Oil SA Pty. Ltd. (private, 100%)	Calref refinery in Cape Town	40,300.
Phosphate rock		Phosphate Development Corp. Ltd. (Foskor Ltd.) (Industrial Development Corp., 100%)	Foskor Mine and plant at Phalaborwa	3,850 phosphate rock.[3]
Do.		Fer-Min-Ore Ltd.	Plant at Germiston	30.
Do.		do.	Plant at Isithebe	12.
Phosphoric acid		Sasol Ltd.	Plant at Phalaborwa	325.
Platinum-group metals		Anglo American Platinum Corp. Ltd.	Rustenburg section near Rustenburg	12,000 ore.
Do.	kilograms	do.	do.	24,000 platinum; 13,000 palladium; 3,300 rhodium.
Do.		do.	Amandelbult section	7,000 ore.
Do.	kilograms	do.	do.	18,000 platinum; 8,700 palladium; 2,300 rhodium.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals—Continued		Anglo American Platinum Corp. Ltd., 85%	Union section	6,000 ore.
Do.	kilograms	do.	do.	10,000 platinum; 4,800 palladium; 1,700 rhodium.
Do.		Bafokeng Rasimone Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, and Royal Bafokeng Nation, 50%)	Bafokeng Rasimone Mine in Northern Province	2,400 ore.
Do.	kilograms	do.	do.	11,000 platinum; 4,700 palladium; 770 rhodium.
Do.	do.	Kroondal Platinum Mines (Anglo American Platinum Corp. Ltd., 50%, and Aquarius Platinum Ltd., 50%)	Kroondal Mine	9,300 platinum; 4,600 palladium; 1,700 rhodium.
Do.		Modikwa Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, and African Rainbow Minerals, 50%)	Modikwa Mine	2,400 ore.
Do.	kilograms	do.	do.	7,600 platinum; 7,600 palladium; 1,500 rhodium.
Do.		Anglo American Platinum Corp. Ltd.	Potgietersrust Platinum Mine	5,000 ore.
Do.	kilograms	do.	do.	6,000 platinum; 6,200 palladium; 430 rhodium.
Do.		do.	Lebowa Platinum (Atok) Mine, 70 kilometers east of Potgietersrus	1,860 ore.
Do.	kilograms	do.	do.	4,100 platinum; 2,700 palladium; 470 rhodium.
Do.		do.	Western Limb Mine	5,400 ore.
Do.	kilograms	do.	do.	1,400 platinum; 550 palladium; 120 rhodium.
Do.		do.	Polokwane smelter	650 concentrate.
Do.		do.	Mortimer smelter	600 concentrate.
Do.		do.	Waterval smelter	200 concentrate.
Do.	kilograms	do.	Mortimer, Polokwante, and Waterval smelters	81,000 platinum; 44,000 palladium; 11,000 rhodium.
Do.	do.	do.	Precious Metals Refinery	81,000 platinum metal; 44,000 palladium metal; 11,000 rhodium metal.
Do.		Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%)	Impala Mines, near Rustenburg in North West Province	17,000 ore.
Do.	kilograms	do.	do.	34,000 platinum; 15,000 palladium; 3,300 rhodium.
Do.		Impala Platinum Ltd.	Marula Mine	2,200 ore.
Do.	kilograms	do.	do.	3,100 platinum; 3,200 palladium; 650 rhodium.
Do.	do.	do.	Smelter, near Rustenburg	71,500 platinum; 33,400 palladium; 8,300 rhodium.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals—Continued	kilograms	Impala Platinum Ltd.	Precious metals refinery, near Springs in Guateng Province	71,500 platinum metal; 33,400 palladium metal; 8,300 rhodium metal.
Do.		Lonmin plc	Marikana Mines (Eastern Platinum, Karee, and Western Platinum, near Rustenburg)	14,400[e] ore.
Do.	kilograms	do.	do.	34,000[e] platinum; 15,000[e] palladium; 4,300[e] rhodium.
Do.		do.	Limpopo Mine[2]	1,000 ore.[e]
Do.	kilograms	do.	do.	1,400 platinum;[e] 970 palladium;[e] 150 rhodium.[e]
Do.	do.	do.	Precious Metals Refinery at Western Platinum	31,000 platinum metal; 14,000 palladium metal; 4,000 rhodium metal.
Do.		Marikana Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, and Aquarius Platinum Ltd., 50%)	Marikana Mine	2,640 ore.
Do.	kilograms	do.	do.	3,100 platinum; 1,400 palladium; 370 rhodium.
Do.		Everest Platinum Mine (Aquarius Platinum Ltd., 50.5%, and Impala Platinum Holdings Ltd., 20%)	Everest Platinum Mine[2]	2,760 ore.
Do.	kilograms	do.	do.	3,800 platinum; 1,900 palladium; 650 rhodium.
Do.		Northam Platinum Ltd. (Anglo American Platinum Corp. Ltd., 22.5%, and Mvelaphanda Resources Ltd., 21.9%)	Northam Mine, 20 kilometers south of Thabazimbi	1,800 Merensky ore. 900 UG2 ore.
Do.	kilograms	do.	do.	7,800 platinum; 7,600 palladium; 1,500 rhodium.
Do.	kilograms	Xstrata plc, 74%	Elandsfontein Mine	7,500.
Do.		Two Rivers Platinum Mine (Pty) Ltd. (African Rainbow Minerals Ltd., 55%, and Impala Platinum Holdings Ltd., 45%)	Two Rivers Platinum Mine near Steelpoort	2,200 ore.
Do.	kilograms	do.	do.	2,800 platinum; 1,700 palladium; 540 rhodium.
Pyrophyllite		Idwala Industrial Minerals (Benoni)	Ottsdal Mine in North West Province	15.
Do.		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Pyrophylite (wonderstone) mine, North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Piet Retief Mine	NA.
Silicon, metal		Grupo Ferroatlantica	Polokwane plant, near Pietersburg	52.[e]
Silver, refined	metric tons	Rand Refinery Ltd.	Germiston, Gauteng Province	200
Sulfur		Sasol Ltd.	Plants at Sasolburg and Secunda	205.
Synthetic fuels	thousand 42-gallon barrels	do.	Coal to oil plant at Secunda	54,800.
Do.	do.	Petroleum Oil and Gas Corporation of South Africa	Natural gas to petroleum products plant at Mossel Bay	18,300.

See footnotes at end of table.

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TABLE 2—Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Titanium:				
Titanium concentrates		Richards Bay Minerals (Rio Tinto Plc., 50%, and BHP Billiton Ltd., 50%)	Open cast operations, near Richards Bay	1,280 ilmenite;[e] 125 rutile.[e]
Do.		Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Exxaro Resources, 100%)	Mine near Brand-se-Baai and mineral separation plant at Koekenaap	540 ilmenite; 25 rutile.
Do.		Exxaro Resources Ltd.	Hillendale Mine near Richards Bay	550 ilmenite; 20 rutile; 5 leucoxene.
Titanium slag		Richards Bay Iron and Titanium (Pty) Ltd./ Richards Bay Minerals (Rio Tinto Plc.)	Smelter at Richards Bay	1,000 titanium slag; 110 rutile.
Do.		Namakwa Sands Ltd.	Smelter at Vredenberg, Saldanha Bay area	200 titanium slag.
Do.		Highveld Steel and Vanadium Corp. Ltd.	Steel plant at Witbank	48 titanium slag.[e]
Do.		Exxaro Resources Ltd.	Empangeni smelter near Richards Bay	250 titanium slag.
Uranium oxide	metric tons	AngloGold Ashanti Ltd.	Vaal Rivers operation, near Klerksdorp	3,000.
Do.	do.	Uranium One Inc.	Dominion Reefs Mine[2]	700.
Vanadium pentoxide	do.	Vanchem Vanadium Products Pty Ltd.	Mapochs Mine near Lydenburg	17,500.
Do.	do.	do.	Plant at Witbank	10,800.
Do.	do.	Xstrata plc	Rhovan Mine at Brits	10,000.
Do.	do.	Vametco Minerals Corp.	Krokodilkraal Mine and plant near Brits	3,800.
Do.	do.	Vanchem Vanadium Products Pty Ltd.	Wapadskloof Mine and plant, 60 kilometers northeast of Middelburg	2,250.[e]
Vermiculite		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	223.
Zinc		Zinc Corp. of South Africa Ltd. (Exxaro Resources Ltd., 100%)	Struisbult Springszinc refinery at Springs, southeast of Johannesburg	110 refined zinc; 170 sulfuric acid.
Do.		Black Mountain Mineral Development Co. (Pty) Ltd.	Black Mountain Mine near Aggeneys in Northern Cape Province	41 zinc in concentrate.
Zirconium		Tisand (Pty) Ltd./Richards Bay Minerals	Open cast mines near Richards Bay	300 zircon in concentrate.
Do.		Namakwa Sands Ltd.	Mine near Brand-se-Baai and mineral separation plant at Koekenaap	125 zircon in concentrate.
Do.		Exxaro Resources Ltd.	Hillendale Mine near Richards Bay, KwaZulu Natal Province	45 zircon in concentrate.
Do.		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	14 baddeleyite.[e]
Do.		do.	Zirconium sulfate plant at Phalaborwa	8 zirconium sulfate.
Do.		Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%)	Plant at Phalaborwa	8 baddeleyite.[e]
Do.		do.	Fused zirconia plant	6 synthetic zirconia.

[e]Estimated. NA Not available.
[1]Table includes data available through February 1, 2010.
[2]Not operating in 2008.
[3]Most of Foskor's phosphate output is from phosphate concentrates supplied by the neighboring Palabora copper mine.

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TABLE 3

SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS IN 2008[1]

(Million metric tons unless otherwise specified)

Commodity		Reserve base
Andalusite[2]		51
Antimony	thousand metric tons	200
Chromium, ore		5,500
Coal, recoverable		30,408
Copper		13
Fluorspar		80
Gold	thousand metric tons	31
Iron ore		1,500
Lead		3
Manganese, ore		4,000
Nickel		12
Phosphate rock, concentrates		2,500
Platinum-group metals	thousand metric tons	70
Titanium minerals		244
Uranium	thousand metric tons	341
Vanadium		12
Vermiculite		80
Zinc		15
Zirconium		14

[1]Metallic minerals are contained metal.

[2]Includes the aluminosilicate and sillimanite.

Source: Mwape, P., Malebo, L.., Mokwena, E., Tjatjie, T., Mnguni, M., Mashaba, P., Musi, L., Perold, W., Andreas, A., and Mudau, S., 2009, General review, *in* South Africa's Mineral Industry 2008/2009: Johannesburg, South Africa, Department of Minerals and Energy of the Republic of South Africa, p. 1-19.

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The Mineral Industry of Sudan

By Thomas R. Yager

In Sudan, increased production of crude petroleum in recent years has substantially strengthened the mineral sector's influence on the national economy. Sudan was not a globally significant producer or consumer of mineral commodities in 2008. Investment in Sudan's petroleum and petrochemical industries by U.S. individuals and organizations was banned by Executive Order 13412, which was issued by the President of the United States in October 2006. The alleged use of revenues from petroleum sales to finance military operations in the Darfur conflict constituted one of the reasons for the Executive Order (Reuters Ltd., 2006).

Minerals in the National Economy

In 2007 (the latest year for which data were available), the petroleum sector accounted for 18.6% of the gross domestic product; manufacturing, 6.3%; and mining and quarrying, 0.6%. The value of output in the petroleum sector grew by 36% compared with that of 2006, and mining and quarrying remained unchanged. In the first half of 2008, crude petroleum exports amounted to $6.63 billion, or 94% of total exports; and petroleum products, 2% (Bank of Sudan, 2008a, p. 7; 2008b, p. 80).

Production

Gold production decreased by 16% in 2008. From 2004 to 2008, gold production decreased by an estimated 54% and crude petroleum production increased by 52%. In 2007, kaolin production increased by 139%; salt, 97%; cement, 61%; and gypsum, 14%. Chromite output decreased by 46% in 2007 (table 1).

Structure of the Mineral Industry

Sudan's crude petroleum was produced by joint ventures of state-owned companies from China, India, Malaysia, and Sudan. The petroleum refineries were also state-owned; the Khartoum Refinery Co., Ltd. was a joint venture between state-owned companies from China and Sudan. China National Petroleum Corp. (CNPC) operated the Khartoum refinery, which accounted for most of the country's refining capacity. The Government held a 56% share in the Hassai gold mine. The cement plants were privately owned.

Commodity Review

Metals

Gold.—In 2008, La Mancha Resources Inc. of Canada produced 2,276 kilograms (kg) of gold at the Hassai Mine compared with 2,703 kg in 2007. Production declined in 2008 because of delays in commissioning the quartz ore milling circuit and water shortages that led to a decrease in gold recovery rates. In 2009, La Mancha planned to spend $1.9 million on exploration; the company hoped to complete an update of its resources in tailings and a feasibility study on a new processing plant (La Mancha Resources Inc., 2009a, b).

In September 2008, Ansan Wikfs Investments Company Ltd. signed an agreement with the Government to explore for gold in Red Sea State. The Government also awarded two licenses for gold exploration to Al-Sharif and Managem SA at Wadi-Gigiya in September (Heavens, 2008).

Industrial Minerals

Cement.—The Atbara and the Rabak cement plants, which produced 326,200 metric tons of cement in 2007, supplied about 10% of Sudan's cement demand. By 2015, demand was expected to increase to more than 23 million metric tons. In 2008, ASEC Cement Co. of Egypt was building a new cement plant at Atbara with a capacity of 1.5 million metric tons per year (Mt/yr). ASEC planned to start production by the first quarter of 2010. Alsalam Cement Production Co. was building a plant near Atbara; its capacity was expected to reach 1.8 Mt/yr in January 2010. Al-Nefiedi Group planned to complete a new cement plant with a capacity of 1 Mt/yr in 2010 and to increase the capacity to 2 Mt/yr in 2011 and 3 Mt/yr in 2012. Berber Cement Co. also planned to build a cement plant with a capacity of 1.5 Mt/yr (Abdelsalam, 2008; Bank of Sudan, 2008b, p. 94; Citadel Capital SAE, 2009, p. 17).

Mineral Fuels and Related Materials

Natural Gas and Petroleum.—In 2008, Sudan's production of crude petroleum decreased by about 4%. The Greater Nile Petroleum Operating Co. [CNPC (40%), Petronas Carigali Overseas Shd. Bhd. of Malaysia, (30%), ONGC Videsh Ltd. of India (25%), and Sudan Petroleum Company Ltd. (Sudapet) (5%)] produced crude petroleum in Blocks 1, 2, and 4 in south central Sudan. In 2008, production in Blocks 1, 2, and 4 declined to 205,000 barrels per day (bbl/d) from 246,000 bbl/d in 2007. The decline in output may be attributable to overproduction in previous years (Sudan Ministry of Finance, 2008; 2009, p. 7).

CNPC held Block 6, which was located to the northwest of Muglad. In 2008, production in Block 6 decreased to 36,000 bbl/d from an estimated 39,000 bbl/d in 2007. CNPC reportedly planned to increase production to 60,000 bbl/d by the end of 2008 (Dow Jones Newswires, 2008; Sudan Ministry of Finance, 2008; 2009, p. 7).

Blocks 3 and 7 in eastern Sudan were held by the Petrodar Consortium [CNPC (41%), Petronas (40%), Sudapet (8%), China Petroleum and Chemical Corp. (6%), and the Al-Thani Group of Sudan (5%)]. In 2008, production in Blocks 3 and 7 increased to 198,000 bbl/d from 175,000 bbl/d in 2007. Output increased because of newly drilled wells, which included horizontal wells (Sudan Ministry of Finance, 2008; 2009, p. 7).

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Blocks 5A and 5B are located in the Muglad Basin. Block 5A was held by White Nile Petroleum Operating Co. [Petronas (68.9%), ONGC Videsh (24.1%), and Sudapet (7%)]. Output was about 22,000 bbl/d in 2008 compared with 24,000 bbl/d in 2007. Block 5B was held by Petronas (39%), Lundin Petroleum AB of Sweden (24.5%), ONGC Videsh (23.5%), and Sudapet (13%). In December 2008, the Muny Deng-1 well drilled in Block 5B was reported to be dry (Petroleum Economist, 2008; Sudan Ministry of Finance, 2008; 2009, p. 7).

Kuwait Foreign Petroleum Exploration Co., Nile Petroleum Corp. (which was owned by the governing authorities of South Sudan), Sudapet, and Total S.A. of France held Block B in southern Sudan. In June 2007, the National Petroleum Commission upheld Total's exploration rights in Block B, which were disputed by White Nile Ltd. of the United Kingdom. White Nile abandoned all claims to Block B in December 2008 (Watkins, 2008).

CNPC operated a petroleum products refinery at Jali with a capacity of 100,000 bbl/d; the company accounted for most of Sudan's refined petroleum products output. In May and June 2008, pne-half of the refinery was shut down for maintenance. The partial shutdown of the refinery accounted for the estimated 7% decrease in national petroleum products output (Irish, 2008).

Petronas was engaged in a joint venture with the Government of Sudan to build a new refinery at Port Sudan with a capacity of 100,000 bbl/d. In May 2008, Petronas announced that it was delaying work on the project because of the increase in estimated costs to $5 billion from $2 billion (Irish, 2008).

In 2008, Ansan and Sudapet were engaged in exploration at Block 17, which is located south of Block 6. Ansan and its joint-venture partners also explored at Block 12A in North Darfur State. In November 2008, Petronas and Sudapet discovered natural gas reserves of 15 billion cubic meters at Hosan in Block 8, which is located northeast of Block 7. PetroSA of South Africa started seismic work on Block 14 in northern Sudan in early 2008 (Dow Jones Newswires, 2008; Karrar, 2009).

Uranium.—Brinkley Mining plc of the United Kingdom and its joint venture partner New Kush Exploration and Mining Company Ltd. explored for uranium in Eastern Equatoria State. The companies completed an aeromagnetic and radiometric survey in mid-November 2008; further exploration was planned for 2009 (Brinkley Mining plc, 2008).

Outlook

The Government planned to increase crude petroleum production to 600,000 bbl/d by mid-2009; higher production was likely to be attributable to Blocks 3, 6, and 7. Further increases in production could come from Block 5A. These increases could more than offset lower output from Blocks 1, 2, and 4. Cement and limestone production was expected to increase sharply from 2008 to 2012; cement output could reach nearly 7.65 Mt/yr in 2012. Little change was expected for chromite, gold, and silver production (Dow Jones Newswires, 2008).

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TABLE 1
SUDAN: PRODUCTION OF MINERAL COMMODITIES [1]

Commodity[2]		2004	2005	2006	2007	2008[e]
Cement, hydraulic	metric tons	307,100	331,200	202,200	326,200 [r]	330,000
Chromite, mine output, gross weight[3]	do.	26,000	21,654	28,772	15,476	15,000
Gold, mine output, Au content[4]	kilograms	5,000 [e]	3,625	3,158	2,703 [r]	2,276 [5]
Gypsum[e]	metric tons	11,000 [r]	9,000 [r]	7,000 [r, 5]	7,974 [r, 5]	8,000
Kaolin	do.	NA	NA	11,641	27,846	28,000
Manganese ore	do.	NA	NA	--	400	400
Marble[e]	cubic meters	24,000	24,000	26,000	26,000	26,000
Petroleum:						
Crude, including lease condensate	thousand 42-gallon barrels	111,000	126,000	132,738 [r]	176,574	168,898 [5]
Refinery products:						
Liquefied petroleum gas	do.	3,235	3,010	3,742	3,587 [r]	3,300
Gasoline	do.	8,109	7,827	9,717	10,279 [r]	9,600
Naphtha	do.	248	248	216	170 [r]	160
Jet fuel	do.	1,562	1,596	1,445	929 [r]	870
Kerosene	do.	294	340	320	239 [r]	220
Distillate fuel oil	do.	9,708	9,965	13,554	15,410 [r]	14,300
Residual fuel oil	do.	2,444	2,589	2,566	4,175 [r]	3,900
Total	do.	25,600	25,575	31,560	34,789 [r]	32,400
Salt[e]	metric tons	45,000 [r]	30,000 [r]	11,638 [r, 5]	22,922 [r, 5]	23,000
Silver[e]	kilograms	2,800	2,600 [r]	2,437 [r, 5]	2,405 [r, 5]	2,400
Steel, semimanufactured[e]	metric tons	35,740 [5]	67,015 [5]	67,000	67,000	67,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Diito. NA Not available. -- Zero.
[1]Table includes data available through August 12, 2009.
[2]In addition to the commodities listed, the following are presumably produced although available information is inadequate to estimate output: clay and (or) shale for cement manufacture (normally about 0.4 metric ton of clay and (or) shale per metric ton of finished cement); limestone for cement manufacture (normally at least 1.25 metric tons per metric ton of finished cement), agriculture, lime manufacture, and construction aggregate and fill; other construction materials (clays, sand and gravel, stone, and others for local use); and mica.
[3]Presumed to be ores and concentrates with an estimated average grade of about 54% chromic oxide.
[4]Does not include artisanal output.
[5]Reported figure.

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TABLE 2
SUDAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Al-Rahji Group	Plant at Atbara	400,000
Do.		Nile Cement Company Ltd.	Plant at Rabak	150,000
Chromite		Ingessana Hills Mines Corp.	Mine at Ingessana Hills	48,000
Gold	kilograms	Compagnie Miniere Or (Government of Sudan, 56%, and La Mancha Resources Inc., 40%)	Mine at Hassai	5,000
Gypsum		Sudanese Mining Corp. (Government, 100%)	Bir Eit Mine in Red Sea State	15,000
Limestone		Al-Rahji Group	Mine at Atbara	500,000
Do.		Nile Cement Company Ltd.	Mine at Rabak	200,000
Mica		Sudanese Mining Corp. (Government, 100%)	Mines at Sheriek	1,800
Petroleum:				
Crude	thousand 42-gallon barrels	Petrodar Consortium [China National Petroleum Corp. (CNPC), 41%; Petronas Carigali Overseas Shd. Bhd., 40%; Sudan Petroleum Company Ltd., 8%; China Petroleum and Chemical Corp., 6%; Al-Thani Group, 5%]	Blocks 3 and 7 in Upper Nile Stat	82,000
Do.	do.	Greater Nile Petroleum Operating Co. [China National Petroleum Corp. (CNPC), 40%; Petronas Carigali Overseas Shd. Bhd., 30%; ONGC Videsh Ltd., 25%; Sudan Petroleum Company Ltd. (Sudapet), 5%]	Blocks 1, 2, and 4 in Unity State	75,000
Do.	do.	China National Petroleum Corp. (CNPC)	Block 6 near Muglad	14,600
Do.	do.	White Nile Petroleum Operating Co. [Petronas Carigali Overseas Shd. Bhd., 68.9%; ONGC Videsh Ltd., 24.1%; Sudan Petroleum Company Ltd. (Sudapet), 7%]	Block 5A in Unity State	8,800
Refined	do.	Khartoum Refinery Co., Ltd. [China National Petroleum Corp. (CNPC), 50%, and Sudanese Petroleum Corp., 50%]	Refinery at Jali	36,500
Do.	do.	Port Sudan Refining Ltd. (Government, 100%)	Refinery at Port Sudan	7,900
Steel:				
Crude		Sudan Master Technology	Plant at Giad Industrial City	60,000
Rebar		do.	do.	150,000
Do.		Sudanese Steel Products Ltd. (subsidiary of Hafez Elsayad Barbary Ltd.)	Plant at Khartoum	150,000
Galvanized		do.	do.	20,000

Do., do. Ditto.

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The Mineral Industry of Tanzania

By Thomas R. Yager

In 2008, Tanzania was the world's only producer of tanzanite. The country also played a significant role in the global production of gold, accounting for nearly 2% of the world's gold mine output. Other domestically significant mining and mineral processing operations included cement and diamond. Tanzania was not a globally significant consumer of minerals or mineral fuels (George, 2009).

Minerals in the National Economy

In 2007 (the latest year for which data were available), the manufacturing sector accounted for 7.8% of the gross domestic product, and mining and quarrying, 3.5%. The value of output in the mining sector grew by 10.7% in 2007 after increasing by 15.6% in 2006. Formal employment in the mining sector amounted to about 8,000; an estimated 500,000 artisanal miners produced colored gemstones, diamond, gold, and other commodities (Ministry of Finance and Economic Affairs, 2008, p. 11, 15).

Government Policies and Programs

The mining sector is regulated by the Mining Act of 1998, which, when enacted, simplified previous laws on mining and mineral trading. Tanzania is a signatory to the Kimberley Process Certification Scheme, which is a certification system established to reduce the trade in conflict diamond.

In November 2007, the Government appointed the Mining Review Contracts Committee to review all mining contracts. In July 2008, the Committee recommended that the Government own 10% of the shares of all mining companies in Tanzania and eliminate tax relief for fuel imports by gold mining companies. The Committee also recommended that mining royalties on metals be increased to 5% from 3%; rough diamond and colored gemstones, to 7% from 5%; and cut diamond and colored gemstones, to 3% from 0% (Mining Journal, 2008b).

The Government reported that an average of about 500 exploration licenses per month were issued in fiscal year 2007-08 compared with about 240 per month in fiscal year 2006-07. The increase was partially attributable to reforms in the licensing process (Mining Journal, 2008b).

Production

In 2008, the production of semimanufactured steel increased by 68%. Diamond production decreased by an estimated 36%; tanzanite and other colored gemstones, by an estimated 25%; copper, by an estimated 18%; and gold, by an estimated 10%.

Structure of the Mineral Industry

Tanzania's gold mines were privately owned; the Minjingu phosphate mines and the Nyanza salt mines were also owned by private investors. The Government held minority interests in the privately owned Kiwira coal mine and the Williamson diamond mine. Artisanal miners accounted for most of the country's colored gemstone production; crushed stone, diamond, and gold were also produced by artisanal miners.

Mineral Trade

Gold exports increased in value to $899 million in 2008 from $788 million in 2007. In 2008, the share of gold in total exports was 34%; diamond, 1%; and colored gemstones, copper, silver, and other minerals combined, 2%. The Bank of Tanzania reported that imports of petroleum products increased in value to nearly $1.8 billion in 2008 from $1.46 billion in 2007. Petroleum products accounted for 26% of the value of total imports, and fertilizers, 2% (Bank of Tanzania, 2009, p. 26).

Commodity Review

Metals

Cobalt, Copper, and Nickel.—Barrick Gold Corp. of Canada produced copper as a coproduct at the Bulyanhulu gold mine. Reserves at Bulyanhulu were estimated to be about 200,000 metric tons (t) of contained copper (Barrick Gold Corp., 2009a, p. 146).

Barrick (50%) and Xstrata plc of Switzerland (50%) had a joint venture for the exploration and development of the Kabanga nickel sulfide deposit in northwestern Tanzania. Resources at Kabanga were estimated to be 50.7 million metric tons (Mt) at a grade of 2.38% nickel; the deposit also contained cobalt, copper, and platinum. Barrick and Xstrata planned to complete a feasibility study of the development of Kabanga in 2009 (Barrick Gold Corp., 2009a, p. 46, 147).

African Eagle Resources plc (AER) of the United Kingdom conducted a drilling program at the Dutwa nickel-cobalt deposit. In November 2008, AER estimated that resources at Dutwa were 31 Mt at a grade of 1.1% nickel and 0.034% cobalt. The company also explored for nickel at its Zanzui project (Mining Journal, 2008a).

IMX Resources Ltd. of Australia (formerly Goldstream Mining NL) and Albidon Ltd. of Australia engaged in chip sampling and mapping at the Luwumbu platinum-group-metal–nickel project near Lake Malawi in the third quarter of 2008. In March, Lonmin plc of the United Kingdom withdrew from its joint-venture agreement with IMX and Albidon to explore at Luwumbu. Lonmin explored for nickel and copper at the Mibango project near Lake Tanganyika, which was a joint venture with IMX. Resources at Mibango were estimated to be 113 Mt at a grade of 0.82% nickel and 0.05% cobalt. Lonmin planned to spend $4.9 million on exploration in 2008; the company was required to complete a feasibility study by March 2015 to earn a 60% interest in the project (IMX Resources Ltd., 2008, p. 30-34).

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Continental Nickel Ltd. of Canada and its joint-venture partner IMX started a drilling program at Nachingwea in southeast Tanzania in July. The cost of the program was estimated to be $6.6 million (Mining Journal, 2008c).

Obtala Resources plc of the United Kingdom engaged in soil sampling at the Ruhenge property in 2008; Ruhenge is located near the Kabanga deposit. The company planned further exploration in the third quarter of 2009. Gulf Resources Ltd. of Australia initiated a pre-scoping study at Pare in northeast Tanzania (Mining Journal, 2008c; Obtala Resources plc, 2009, p. 6-7).

Gold.—Tanzania's gold production declined to an estimated 36,000 kilograms (kg) in 2008 from an estimated 40,193 kg in 2007. The Bulyanhulu, the Geita, the Golden Pride, the North Mara, and the Tulawaka Mines had a combined capacity to produce about 44,700 kilograms per year (kg/yr) of gold. Tanzania's resources amounted to about 1,500 t of contained gold, of which about 740 t was reserves (tables 1, 2, and 3).

Barrick operated the Bulyanhulu underground gold mine, which produced copper and silver as coproducts. In 2008, the Bulyanhulu Mine produced about 6,200 kg of gold compared with nearly 7,600 kg in 2007. Lower volumes of ore mined because of labor disputes in the fourth quarter of 2007 and lower ore grades more than offset higher recovery rates. Barrick planned to increase production at Bulyanhulu in 2009. The remaining life of the Bulyanhulu Mine was expected to be nearly 25 years (Mining Review Africa, 2007; Barrick Gold Corp., 2009a, p. 45; 2009b).

In 2008, production at the North Mara open pit mine amounted to about 6,100 kg of gold compared with 7,400 kg in 2007. Lower volumes of ore were mined, and ore grades and recovery rates declined in 2008. Production was constrained by equipment problems and local civil unrest (Barrick Gold Corp., 2009a, p. 45; 2009b).

Barrick and its joint-venture partner Explorations Minières du Nord Ltée (MDN) of Canada produced gold at the Tulawaka open pit mine. Production at Tulawaka increased to about 6,600 kg in 2008 from nearly 5,600 kg in 2007. Higher ore grades and recovery rates more than offset lower volumes of ore mined. In September 2008, underground mining started as near-surface reserves were depleted; production was expected to decline in 2009 as a result of the cessation of surface mining (Barrick Gold Corp., 2009a, p. 45; 2009b).

At the end of 2008, Barrick had completed 90% of the construction of a new open pit mine at the Buzwagi deposit. The mine was expected to start production in the second quarter of 2009; output for 2009 was likely to be about 6,200 kg. Starting in 2010, Barrick planned to produce nearly 7,800 kg/yr of gold and 4,100 metric tons per year (t/yr) of copper; the life of the mine was expected to be 10 years. Capital costs for the project were estimated to be $400 million (Mining Review Africa, 2007; Barrick Gold Corp., 2009a, p. 13, 46).

In 2008, Geita Gold Mining Ltd. (a subsidiary of AngloGold Ashanti Ltd. of South Africa) produced 8,203 kg of gold at the Geita Mine compared with 10,166 kg in 2007. Production was constrained by the collapse of the Nyankanga pit wall in February 2007, which restricted access to deeper high-grade ore, and breakdowns in processing operations in the second and third quarters of 2008. Production at Geita was expected to increase to 9,800 kg in 2009 because of higher ore grades. AngloGold Ashanti also engaged in exploration at Geita in 2008 (AngloGold Ashanti Ltd., 2009, p. 17, 78-79, 95, 225).

Resolute Mining Ltd. of Australia owned the Golden Pride open pit mine. In fiscal year 2007-08, the Golden Pride Mine produced 4,672 kg of gold compared with 4,305 kg in fiscal year 2006-07. Higher production was attributable to increased ore grades and recovery rates (Resolute Mining Ltd., 2008, p. 9).

In February 2008, Resolute purchased the share of the Nyakafuru joint-venture project held by IAMGOLD Corp. of Canada. Resolute recommenced exploration at Nyakafuru in July. In the third quarter of 2008, the company conducted drilling at the Kahama project, which was a joint venture with Sub-Sahara Resources NL of Australia. Resolute also explored at Kavsav and at the Golden Pride East joint-venture project with Barrick (Resolute Mining Ltd., 2008, p. 23-24; Sub-Sahara Resources NL, 2008).

IAMGOLD spent $4.6 million on exploration at the Buckreef deposit in north-central Tanzania in 2008. At yearend, resources at Buckreef were estimated to be 27.8 Mt at a grade of 2.1 grams per metric ton (g/t) gold (IAMGOLD Corp., 2009, p. 62, 147).

Currie Rose Resources Inc. of Canada and Sub-Sahara explored at the Mabale Hills and the Nyamirembe properties in 2008. The companies completed a drilling program at Mabale Hills in June. Sub-Sahara curtailed its exploration activities in Tanzania by the fourth quarter of 2008 because of the world financial crisis (Mining Journal, 2008c; Sub-Sahara Resources NL, 2008).

United Kingdom companies AER and Randgold Resources Ltd. engaged in exploration at Miyabi in the first half of 2008. Randgold planned to fund further exploration and a prefeasibility study. Resources at Miyabi were estimated to be 12.4 Mt at a grade of 1.3 g/t gold (Mining Journal, 2008c).

In 2008, MDN carried out exploration at the Simba project, which is located north of the Tulawaka Mine, and the Viyonza project, which is located near the Tulawaka Mine. MDN planned an exploration budget of about $5 million for Tanzania in 2008, most of which was expected to be spent on Simba and Viyonza (Saywell, 2008).

In July, Lake Victoria Mining Co. of the United States commenced exploration at its Kalemela project. Obtala Resources engaged in sampling at its Buckreef and Shinyanga properties, which are located near the closed Buckreef gold mine and the Williamson diamond mine, respectively. In December, Lakota Resources completed a drilling program at the Tembo project west of the Bulyanhulu Mine. In July, Helio Resource Corp. of Namibia started a drilling program at the SMP property in the Lupa Goldfield in southwest Tanzania. Peak Resources Ltd. of Australia started exploration at its Geita project (located near the Geita Mine), at Igunga (located southwest of the Golden Pride Mine), and in the Lupa Goldfield. Great Basin Gold Ltd. of South Africa also explored in the Lupa Goldfield in 2008 (Mining Journal, 2008c; Alexander, 2009; Obtala Resources plc, 2009, p. 5-7).

Industrial Minerals

Cement.—In 2008, cement production increased to 1.76 Mt from 1.65 Mt in 2007. Tanga Cement Company Ltd. planned to

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increase its capacity to 1.25 million metric tons per year (Mt/yr) from 750,000 t/yr. The expansion was to be completed by the third quarter of 2009. Tanzania Portland Cement Company Ltd. (TPCC) planned to increase its capacity to more than 1.4 Mt/yr from 670,000 t/yr. The expansion was expected to be completed in the second quarter of 2009 at a cost of about $100 million. In the fourth quarter of 2008, Athi River Mining Ltd. of Kenya (ARM) started construction on its new cement plant, which had a planned capacity of 1.5 Mt/yr. ARM expected to start production at the plant in 2011 (Andrew, 2008; Guardian, The, 2008; Athi River Mining Ltd., 2009, p. 6).

Diamond.—Diamond recovery at the Williamson Mine declined to 134,000 carats in 2008 from 220,000 carats in 2007. Lower output was primarily attributable to decreased volumes of ore mined. In November 2008, Petra Diamonds Ltd. purchased the De Beers Group's 75% share in the mine. Petra planned to increase production to more than 280,000 carats per year. The company was also studying the construction of a new ore treatment plant that would increase capacity to 7.5 Mt/yr from 4 Mt/yr. Depending on the results of the study, diamond production could increase to about 500,000 carats per year. Resources at Williamson were estimated to be about 40 million carats (African Mining, 2009; De Beers Group, 2009, p. 16).

More than 300 kimberlites had been identified in the Mbeya, the Ngeza, the Shinyanga, and the Singida-Iramba Provinces, of which 20% were diamondiferous. KimCor Diamonds plc of Australia and De Beers engaged in exploration for diamond at the Itanana and the Mahene kimberlite pipes in the first quarter of 2008. In December, KimCor agreed to sell its diamond operations to Belmont Mining Ltd. of the United Kingdom (KimCor Diamonds plc, 2008; Mining Journal, 2008c).

Gemstones.—Tanzania produced a variety of gemstones that included amethyst, aquamarine, cordierite, emerald, garnet, ruby, sapphire, spinel, tanzanite, and tourmaline. Tanzanite accounted for a majority of the value of domestic gemstone mining.

Merelani, which is located near Arusha, was the world's only source of tanzanite. Artisanal and small-scale miners operating in Blocks B and D of the Merelani deposit accounted for most of the country's tanzanite production. Kilimanjaro Mines Ltd. and Tanzanite Africa Ltd. operated medium-scale mines in Block A and the Block D Extension, respectively. In the fourth quarter of 2008, nearly 200 mining operations in Blocks B and D suspended production because of the decline in tanzanite prices resulting from the world economic crisis (Ihucha, 2009).

TanzaniteOne Ltd. of South Africa mined tanzanite in Block C; the company also cut high-quality tanzanite at its lapidaries in Tanzania. In 2008, TanzaniteOne produced 441 kg of rough tanzanite compared with 340 kg in 2007 and 246 kg in 2006; increased volumes of ore processed more than offset lower ore grades. The company planned to cut its production to about 320 kg in 2009 because of the world economic crisis; output was expected to increase to more than 600 kg by 2012. TanzaniteOne also engaged in exploration on properties near Block C in 2008 (TanzaniteOne Ltd., 2009, p. 8-9, 13).

Tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium, was produced at Ruangwa by about 300 artisanal miners. Gemini Exploration and Mining Co. also operated a mechanized mine at Ruangwa. Tsavorite was mined in small amounts at Tunduru. Swala Gem Traders operated a mechanized tsavorite mining operation at Lemshuku. In 2008, TanzaniteOne set up a pilot plant and conducted bulk sampling at the Lemshuku-Shamberai tsavorite project, which was located about 20 kilometers southwest of the tanzanite mines. The company planned to continue with bulk sampling in the second half of 2009 (Pardieu and Hughes, 2009; TanzaniteOne Ltd., 2009, p. 17).

Spessartine, which is an orange garnet that obtains its color from manganese that is part of its chemical structure, was produced by small-scale miners near Lolindo in northern Tanzania. The mine produced at a rate of about 3 kilograms per month of gem-quality spessartine (Chadwick and others, 2008).

In December 2007, a ruby and sapphire rush started at Winza in central Tanzania. Artisanal miners started producing high-quality ruby and blue, pink, and purple sapphire from eluvial deposits. Mining from the primary deposit started in March 2008. The number of miners working at Winza increased to 6,000 in July 2008 from 600 in December 2007. By October 2008, the eluvial deposits were reportedly depleted; mining continued on a reduced scale from the primary deposit (Schwarz and others, 2008, p. 322-326).

Ruby and sapphire were also mined at Matombo and Mahenge in the Morogoro District and at Songea and Tunduru in southern Tanzania. In 2007, about 1,000 workers were involved in gemstone mining and trading at Tunduru compared with tens of thousands from 1995 to 1999. The decline was attributable to a lack of investment in the mines and the discovery of the Ilakaka sapphire deposits, which drew gemstone dealers to Madagascar and left the miners at Tunduru without a market for their gemstones. World Gem Supply Ltd. of Australia operated a mechanized ruby and sapphire mine at Masuguro, which is located near Songea. In July 2008, Obtala Resources was awarded a mining license for ruby in the Morogoro District (Schwarz and others, 2008, p. 323; Obtala Resources plc, 2009, p. 2; Pardieu and Hughes, 2009).

Artisanal and small-scale miners produced alexandrite and emerald from four mines near Lake Manyara in the Mbulu District in north-central Tanzania. Alexandrite was also produced at Tunduru, and emerald, in the Sumbawanga District. In April, Obtala Resources was awarded six mining licenses for emerald near Lake Manyara (Obtala Resources plc, 2009, p. 2).

Lime.—ARM of Kenya produced lime for consumption in gold mining, sugar refining, and water treatment at its plant in Tanga. Production declined in 2007 because of shutdowns to replace refractory bricks. ARM planned to double its capacity to 40,000 t/yr (Ondari, 2008).

Phosphate Rock.—Small amounts of phosphate rock were mined at Minjingu by Minjingu Mines and Fertilizers Ltd. In September, Peak Resources formed a joint venture with Minergy Tanzania Ltd. of Mauritius to explore for phosphates at the Ngualla carbonatite in southwest Tanzania (Alexander, 2009).

Soda Ash.—Tata Chemicals Ltd. (TCL) of India planned to mine soda ash from Lake Natron in northeast Tanzania. The company planned to build a processing plant with a capacity of 500,000 t/yr. In November 2008, TCL suspended development because of environmental concerns about habitat destruction.

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Resumption of the project depended on approval of the Government's wetlands management plan and the results of studies on the environmental effects of mining at Lake Natron (Industrial Minerals, 2008).

Mineral Fuels and Related Materials

Coal.—In the fourth quarter of 2008, Atomic Resources Ltd. of Australia and its joint-venture partner National Development Corp. (owned by the Government of Tanzania) completed a scoping study on the Ngaka coal deposit. The companies planned to complete a new resource assessment and to start a feasibility study of a new mine and a coal-fired powerplant at Ngaka in the first quarter of 2009 (Atomic Minerals Ltd., 2009).

Natural Gas.—Orca Exploration Group Inc. produced natural gas from Songo Songo Island. The company produced 561 million cubic meters in 2008 compared with 544 million cubic meters in 2007. In the fourth quarter of 2008, Orca increased the capacity of the processing plant to 930 million cubic meters per year from 720 million cubic meters per year. Orca expected local natural gas demand to increase to between 1.45 billion and 1.65 billion cubic meters by 2012; the company planned to expand the capacity of the pipeline and the gas processing plant to nearly 2.1 billion cubic meters per year. The leading local consumers of natural gas were powerplants and TPCC's cement plant (Orca Exploration Group Inc., 2009, p. 9, 18-19).

Artumas Group Inc. of Canada supplied a 12-megawatt (MW) gas-fired powerplant at Mtwara from its production facilities in Mnazi Bay. The company planned to build a new gas-fired powerplant at Mtwara with a capacity of 300 MW by 2012 and to export compressed natural gas to Kenya by 2010. The new powerplant was expected to consume 650 million cubic meters per year of natural gas. Kenya was likely to consume 360 million cubic meters per year starting in 2010 and 520 million cubic meters per year starting in 2013. The powerplant and compressed natural gas projects received Government approval in July and August 2008, respectively (Artumas Group Inc., 2008, p. 10).

Aminex plc of the United Kingdom and its joint-venture partners drilled an exploration well at its Nyuni/East Songo Songo property in 2008. In July, Aminex and Key Petroleum Ltd. of Australia acquired the Songo Songo West property (Petroleum Economist, 2008a).

Petroleum.—Maurel & Prom of France and Dominion Petroleum Ltd. of Bermuda planned to drill at the onshore Mandawa license by the end of 2008. Aminex planned to drill a well at Ruvuma in southern Tanzania in early 2009. Heritage Oil Corp. of Canada started a seismic acquisition program at the Kimbiji and the Kisangire Blocks in September; the company planned to start drilling in the second half of 2009. In May, the Government granted the South Block, which covered the southern half of Lake Tanganyika and the adjacent shore, to Beach Petroleum Ltd. of Australia (Petroleum Economist, 2008b; Watkins, 2008).

Uranium.—In November 2008, Mantra Resources Ltd. of Australia completed a drilling program at the Mkuju River property. Mantra planned to complete a resource estimate in early February 2009 and a scoping study in the second quarter of 2009. The company also explored for uranium at Mbabmba Bay in southwest Tanzania (Mantra Resources Ltd., 2009, p. 1, 7).

Uranex NL of Australia (IMX Resources NL Ltd., 39.5%) explored for uranium at its Bahi, Mkuju, and Songea properties in 2008. In June, Uranex announced that resources at Bahi were estimated to be 14 Mt at a grade of 0.0218% uranium oxide (Mining Journal, 2008c).

In mid-2008, Uranium Resources plc of the United Kingdom and Western Metals Ltd. of Australia engaged in a drilling program at the Mtonya project in southern Tanzania. Uranium Hunter Corp. of Canada explored at Ruhuhu in the second half of 2008. Obtala Resources planned to start exploration for uranium in the third quarter of 2009 (Mining Journal, 2008c; Obtala Resources plc, 2009, p. 7).

Outlook

Tanzania's production of cement, copper, diamond, gold, lime, and natural gas is expected to increase in the near future. In 2009 and 2010, increased gold output from the Bulyanhulu and the Geita Mines and the opening of the Buzwagi Mine are likely to more than offset the shutdown of the Tulawaka Mine. Gold production is expected to decline after 2012 because of the shutdown of the Golden Pride Mine. Colored gemstone production is likely to decrease in 2009 because of the world economic crisis. Artisanal tanzanite production could decline because of resource depletion; it is unclear to what extent increased production by TanzaniteOne by 2012 would offset the decline.

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TABLE 1

TANZANIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
Bauxite		--	1,640	5,373	5,003	5,000
Calcite[e]		40	40	100 [3]	1,500 [r, 3]	1,500
Cement, hydraulic	thousand metric tons	1,281	1,366	1,370 [r]	1,630 [r]	1,756 [3]
Coal, bituminous		65,041	30,795 [r]	17,940	27,198	27,000
Copper, contained in concentrates and doré		4,240	3,661 [r]	3,284 [r]	3,275 [r]	2,700
Diamond[4]	carats	303,920	219,639	272,204 [r]	282,786	180,000
Gemstones, excluding diamond:[e, 5]						
Amethyst	kilograms	270	270	270	270	200
Aquamarine	do.	280	280	280	280	210
Cordierite (iolite)	do.	310	310	310	310	230
Garnet	do.	5,900	5,900	5,900	5,900	4,400
Ruby	do.	2,700	2,700	2,700	2,700	2,000
Sapphire	do.	1,300	1,300	1,300	1,300	1,000
Tanzanite	do.	3,916 [r, 3]	1,307 [r, 3]	5,894 [r, 3]	8,187 [r, 3]	6,100
Other	do.	1,600,000	616,000 [r]	2,480,000	1,280,000 [r]	960,000
Total	do.	1,613,849 [r, 3]	627,797 [r, 3]	2,498,637 [r, 3]	1,294,485 [r, 3]	970,000
Gold	do.	48,176	47,270 [r]	47,000 [e]	40,193	36,000
Gypsum and anhydrite, crude		59,231	23,119 [r]	32,556 [r]	52,759 [r]	53,000
Kaolin		--	--	--	1,020	1,000
Lime[e]		20,000	20,000	20,000 [r]	15,000 [r]	20,000
Natural gas[6]	million cubic meters	119	408	504	544	561 [3]
Phosphate rock:						
Gross weight		6,570	7,096	2,881	8,261	8,300
P_2O_5 content		2,000	2,100	860	2,500	2,500
Salt, all types		57,062	51,166 [r]	34,798	35,224	35,000
Silver, contained in concentrates and doré	kilograms	13,216	12,480 [r]	14,906	12,381	11,000
Steel, semimanufactured		40,029	47,652	50,654 [r]	46,016 [r]	77,365 [3]
Stone, sand, and gravel:						
Aggregates[e]		120,000	140,000	160,000	180,000	180,000
Dolomite[e]		1,800	1,400	950	169 [r, 3]	170
Limestone, crushed		1,390,894 [r]	2,006,407 [r]	1,607,570 [r]	1,322,023 [r]	1,300,000
Marble		NA	NA	337	370 [e]	370
Pozzolanic materials		152,679	163,499	129,295	184,070	180,000
Sand[e]		3,900,000	5,800,000	7,577,210 [3]	8,400,000	8,400,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available.
-- Zero.

[1]Table includes data available through October 2, 2009.

[2]In addition to the commodities listed, modest quantities of crude construction materials, including brick clay, are produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Diamond figures are estimated to represent 85% gem-quality or semigem-quality and 15% industrial-quality stones. Does not include smuggled artisanal production.

[5]Other precious and semiprecious stones produced include alexandrite, chrysoprase, emerald, kyanite, moonstone, opal, peridot, quartz, spinel, and tourmaline. Does not include smuggled artisanal production.

[6]Orca Exploration Group Inc. only. Artumas Group Inc. also produced small amounts of natural gas in 2007 and 2008.

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TABLE 2
TANZANIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Tanga Cement Company Ltd. (Holcim Mauritius Investment Holdings Ltd., 62.5%)	Plant at Tanga	750,000.
Do.		Tanzania Portland Cement Company Ltd. (TPCC) (HeidelbergCement AG, 69.3%)	Plant at Wazo Hill	670,000.
Do.		Mbeya Cement Company Ltd. (LaFarge Group, 58%)	Plant at Mbeya	300,000.
Coal, bituminous		Kiwira Coal and Power Ltd. (Tanpower Resources Ltd., 85%, and Government, 15%)	Kiwira Mine	150,000 run of mine; 93,000 washed.
Copper, in concentrates and doré		Bulyanhulu Gold Mine Ltd. (Barrick Gold Corp., 100%)	Bulyanhulu Mine near Kahama	3,700.
Diamond		Williamson Diamonds Ltd. (Petra Diamonds Ltd., 75%, and Government, 25%)	Williamson Mine near Shinyanga[1]	4,000,000 ore processing.
Do.	carats	do.	do.	210,000 diamond.
Do.	do.	El Hillal Minerals Ltd.	Near Williamson Mine	24,000.[e]
Glass		Kioo Ltd.	Dar es Salaam	55,000.
Gold		Geita Gold Mining Ltd. (AngloGold Ashanti Ltd., 100%)	Geita Mine near Nyakabale	6,000,000 ore processing.
Do.	kilograms	do.	do.	17,000 gold.
Do.		Bulyanhulu Gold Mine Ltd. (Barrick Gold Corp., 100%)	Bulyanhulu Mine near Kahama	1,100,000 ore processing.
Do.	kilograms	do.	do.	11,000 gold.
Do.		North Mara Gold Mine Ltd. (Barrick Gold Corp., 100%)	North Mara Mine in Tarime District	2,800,000 ore processing.
Do.	kilograms	do.	do.	8,700 gold.
Do.		Resolute Mining Ltd.	Golden Pride Mine near Isanga	3,000,000 ore processing.
Do.	kilograms	do.	do.	4,500 gold.
Do.		Pangea Minerals Ltd. [Barrick Gold Corp., 70%, and Explorations Minières du Nord Ltée (MDN), 30%]	Tulawaka Mine	365,000 ore processing.
Do.	kilograms	do.	do.	3,500 gold.
Do.		Tangold Ltd.	Buhemba Mine, 47 kilometers southeast of Musoma[1]	1,300,000 ore processing.
Do.	kilograms	do.	do.	2,600 gold.
Lime		Athi River Mining Ltd. (ARM)	Plant at Tanga	20,000.
Natural gas	million cubic meters	Orca Exploration Group Inc.	Gasfield on Songo Songo Island	930.
Do.	do.	Artumas Energy (Tanzania) Ltd. (subsidiary of Artumas Group Inc.)	Gasfield at Mnazi Bay	100.
Petroleum products	thousand 42-gallon barrels	Tanzanian and Italian Petroleum Refining Co. Ltd.	Refinery at Dar es Salaam[1]	5,500.
Phosphate rock		Minjingu Mines and Fertilizers Ltd.	Mine at Minjingu	100,000.
Salt		Nyanza Mines (Tanganyika) Ltd.	Nyanza Mines at Uvinza	40,000.
Silver	kilograms	Bulyanhulu Gold Mine Ltd.	Bulyanhulu Mine near Kahama	8,600.
Steel		MM Integrated Steel Mills Ltd.	Plant at Dar es Salaam	36,000[e] rolled.
Do.		Aluminum Africa Ltd.	do.	33,000[e] rolled.
Do.		Steel Masters Ltd.	do.	22,000 rolled.
Do.		MM Integrated Steel Mills Ltd.	do.	36,000 galvanized.
Do.		Aluminum Africa Ltd.	do.	33,000 galvanized.
Tanzanite		TanzaniteOne Ltd.	Mine at Merelani, Block C[2]	120,000 ore processing.
Do.	kilograms	do.	do.	1,200 tanzanite.
Do.	do.	Tanzanite Africa Ltd. (IPP Media Ltd.)	Mine at Merelani, Block D Extension	NA.
Do.	do.	Kilimanjaro Mines Ltd.	Mine at Merelani, Block A	NA.
Do.	do.	Small-scale and artisanal miners	Mines at Merelani, Blocks B and D	7,500.[e]

[e]Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.

[1]Not operating at the end of 2008.

[2]Formerly the graphite processing plant at Merelani operated by Phoenix Minerals Ltd.

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TABLE 3
TANZANIA: GOLD RESOURCES AND RESERVES IN 2008

Project	Major operating companies	Tonnage (million metric tons)	Grade (grams per metric ton)	Contained gold (metric tons)
Reserves:				
Bulyanhulu[1]	Bulyanhulu Gold Mine Ltd. (Barrick Gold Corp., 100%)	37.7	9.9	373
Geita[2]	Geita Gold Mining Ltd. (AngloGold Ashanti Ltd., 100%)	54.3	2.9	159
Buzwagi[1]	Barrick Gold Corp.	65.1	1.5	102
North Mara[1]	North Mara Gold Mine Ltd. (Barrick Gold Corp., 100%)	30.5	3.1	94
Golden Pride[2]	Resolute Mining Ltd.	11.0	1.5	16
Total		198.6	3.7	744
Resources:				
Bulyanhulu	Bulyanhulu Gold Mine Ltd.	37.6	10.0 [3]	425
Geita	Geita Gold Mines	109.0	3.7 [3]	400
Tusker	Barrick Gold Corp., 51%, and Sub-Sahara Resources NL, 49%	123.3	1.2	142
North Mara	North Mara Gold Mine Ltd.	49.6	2.7	131
Buzwagi	Barrick Gold Corp.	85.5	1.5	130
Golden Pride	Resolute Mining Ltd.	36.4	1.6 [3]	59
Buckreef/Rwamagaza	IAMGOLD Corp.	27.8	2.1	59
Golden Ridge	Kahama Mining Corp. Ltd.	33.1	1.5	46
Nyakafuru	Resolute Mining Ltd.	19.4	1.7	33
Mgusu	Shanta Gold Ltd.	6.2	3.7	23
Singida	do.	24.0	1.4	17
Kitongo:				
Main Zone	IAMGOLD Corp.	10.5	1.3	14
Isegenghe Hill	do.	0.2	14.4	2
Miyabi	African Eagle Resources plc	12.4	1.3	16
Tulawaka	Pangea Minerals Ltd. (Barrick Gold Corp., 70%, and Exploration Minières du Nord Ltée, 30%)	1.1	6.7	7
Total		576	2.6	1,504

Do., do. Ditto.

[1]Definitions of resources and reserves are based on National Instrument 43-101, as required by Canadian securities regulatory authorities.

[2]Definitions of resources and reserves are based on the Australasian Code for the Reporting of Identified Mineral Resources and Ore Reserves issued by the Joint Committee for the Australasian Institute of Geoscientists and the Australian Mining Industry Council.

[3]Note that, in most cases, the grade of resources is lower than the grade for reserves, but in this case, the grade of the less economic material is higher, leading to the paradox of a higher resource grade.

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The Mineral Industry of Tunisia

By Mowafa Taib

Production of phosphate rock and phosphate-based fertilizers was Tunisia's major contribution to the world mineral markets. In 2008, Tunisia was ranked as the world's top fifth producer of phosphate rock and accounted for about 4.7% of the world supply of phosphate rock. Additionally, Tunisia produced aluminum fluoride, cement, clay, crude petroleum, fertilizer, gypsum, iron ore, lime, natural gas, refined petroleum products, salt, and steel (Jasinski, 2009).

Minerals in the National Economy

In 2008, the Tunisian mining sector contributed 1.0% of the country's gross domestic product (GDP) at current prices compared with 0.6% of the GDP in 2007. The share of the hydrocarbon sector increased to 8.2% of the GDP from 7.4% in 2007 and 5.5% in 2006. The increase was mainly because of higher crude oil prices in the international markets in 2008. The mining sector's contribution to the growth of Tunisia's industrial sector in real terms decreased by 4.0% in 2008 compared with an increase of 1.0 % in 2007 and 7.6% in 2006. Similarly, the hydrocarbon sector's contribution to the economic growth in 2008 decreased by 6.5% compared with an increase of 22.5% in 2007.

Fuel and industrial minerals played an important role in Tunisia's external trade. The value of energy exports, which included crude oil and refined petroleum products exports, was 17.3% of total exports, and the value of energy imports, which included coal, crude oil, natural gas, and refined petroleum products, was 16.2% of the country's total imports. Exports of phosphate rock and phosphate-based products accounted for 12.4% of the value of total exports, and the value of building materials exports accounted for 1.7% of total exports. Overall, the combined value of building materials, energy, mining, and phosphate products exports was about 32.2% of total exports. Poland received 45% of Tunisia's phosphate rock exports followed by Ukraine, which received about 15%. Exports of diammonium phosphate (DAP) went to India (26%), Turkey (21%), Italy (7%), and France and Vietnam (6% each). The remaining DAP exports were received by China, Iran, and Pakistan. About one-half of the phosphoric acid exports, which increased in value by 158% in 2008 compared with the value in 2007, was destined for India. Triple superphosphate exports, which increased in value by 136% in 2008 compared with the value in 2007, were received mainly by Iran (26%), Brazil, (24%), and Bangladesh (15%). Tunisia's mineral imports included crude oil from Libya, natural gas from Algeria, and refined petroleum products from Switzerland and the United Kingdom. Sulfur imports increased to 1.78 million metric tons (Mt) in 2008 from 1.39 Mt in 2007. About 46% of sulfur imports, which were used for the manufacturing of phosphate-based fertilizers, were mainly from Russia, and the rest were from Kazakhstan, Kuwait, Saudi Arabia, and the United Arab Emirates (Central Bank of Tunisia, 2009, p. 61, 63, 121, 125-126).

The influx of foreign direct investment (FDI) to Tunisia had been on a steady increase in the past 5 years. In 2008, the FDI was $2.76 billion, which was an increase of 64% compared with that of 2007. About 57% of the FDI went to the energy sector whereas 19% went to the manufacturing sector. The increase in investment in the energy and chemical industries was an indication of the degree of success of the Government's policy of upgrading the industry resources to ensure sustainable production (Central Bank of Tunisia, 2009, p. 62).

Government Policies and Programs

The Mining Code (law No. 2003-30 of April 28, 2003) regulated mineral exploration and production activities in Tunisia, and oil and gas production were governed by the Hydrocarbons Code (law No. 99-93 of August 17, 1999) and its supplement (law No. 2002-23 of February 2002). The Hydrocarbons Code allows a prospecting period of 1 year, a maximum of 5 years for exploration, and 30 years for production. The law reduces the tax rate to 50% from 75% if the state-owned Entreprise Tunisienne d'Activités Pétrolières (ETAP) [Tunisian National Oil Co.] holds a 40% share of the concession. In 2008, the Government introduced steps to stimulate and sustain exports, including paying 50% of the employer's contribution to the social security fund in case companies were to lay off workers temporarily or reduce their work to part time from full time (Central Bank of Tunisia, 2009, p. 61).

Production

In 2008, there were notable increases in Tunisia's mineral production, including that of ammonium nitrate, which increased by 396%; crude steel, by 34%; liquefied petroleum gas (LPG), by 21%; iron ore, by 17%; hyperphosphate, by 16%; and salt, by 14%. Production of sodium tripolyphosphate decreased by 22%; dicalcium phosphate, by 18%; phosphoric acid, by 11%; crude oil, by 10%; and phosphate rock, by 4% (table 1).

Structure of the Mineral Industry

Phosphate mining and fertilizer manufacturing activities in Tunisia were carried out by Government-owned Compagnie des Phosphates de Gafsa (CPG) [Gafsa Phosphate Co.]. The Government owned two cement companies, which were responsible for about 25% of the country's cement production; the other three-fourths of the country's cement production came from four private companies (table 2). ETAP continued to enter into partnerships with international and regional oil companies and to monitor hydrocarbon exploration and production operations in the country to protect the interests of the Government. By yearend 2008, ETAP had awarded 36 onshore and 16 offshore permits, including 41 exploration permits and

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11 prospecting permits. In 2008, three prospecting permits (the Jenein Center, the Sidi Mansuor, and the Tozeur) were converted into exploration permits; three 3-year extensions were granted for the Grombalia, the Ras Marmour, and the Nord Des Chotts exploration permits; one 2-year extension was guaranteed for the Sfax offshore exploration permit; one 1-year extension was granted to PA Resources of Sweden for the Makthar exploration permit; and a third renewable period for the Borj El Khadra Exploration Permit was approved (Tunisian National Oil Co., 2008, p. 5; E and P Tunisian News, 2009).

Commodity Review

Metals

Iron and Steel.—In 2008, iron ore production increased by 17% compared with a decrease of 16% in 2007. The iron ore output level in 2008 was similar to levels achieved in 2005 and 2006. The increase in iron ore production was owing to greater output at the Djerissa and the Tamera-Douria Mines. The Djerissa Mine produced 117,000 metric tons (t) of hematite and 14,000 t of siderite, and the Tamera-Douria Mine produced 80,000 t of hematite (Central Bank of Tunisia, 2009, p. 73).

Sales of iron ore to the local market by state-owned Société Tunisienne de Sidérurgie [Tunisian Steel Manufacturing Co.], which was also known as El-Fouladh, increased by 17% compared with those of 2007. El-Fouladh, which produced 82,000 t of billet from locally produced and imported iron ore in 2008, imported an additional 251,000 t of steel rods from Turkey and Ukraine to meet the growing demand of the local market for construction material. Demand for steel products by the domestic market was projected to be 1 million metric tons per year (Mt/yr) by 2010. El-Fouladh moved forward with expanding its production capacity to 200,000 metric tons per year (t/yr) of crude steel from the current (2008) capacity of 100,000 t/yr by constructing a second 100,000-t/yr-capacity electric arc furnace (EAF). The second EAF was expected to be completed in the first quarter of 2009 (Arab Steel, 2008a, b; Central Bank of Tunisia, 2009, p. 73).

Lead and Zinc.—No lead or zinc was produced in Tunisia in 2008 despite intensified exploration activity by Albidon Ltd. and Maghreb Minerals p.l.c. in 2007. Maghreb Minerals was looking for partners for the Bou Jabeur-Gite Este deposit after realizing that production would be too costly under current (2008) lead and zinc prices. The new partner was expected to increase project resources, which would allow for mining more than 0.55 Mt/yr. The company had been exploring for barite, fluorite, lead, silver, and zinc in the Mejerda region in northern Tunisia (Proactiveinvestors UK, 2009).

Industrial Minerals

Cement.—In 2008, production of cement in Tunisia was about 7.88 Mt, including about 7.56 Mt of gray cement and 316,000 t of white cement, White cement was produced solely by Société Tuniso-Andalouse de Ciment Blanc S.A. at Feriana. In addition to the increased demand for cement by the local market, there was greater demand for Tunisian cement by the neighboring markets of Algeria and Libya. In 2008, about 1.67 Mt of cement was exported, mainly to Libya, compared with 1.55 Mt in 2007.

Cementos de Portugal SGPS, S.A. (Cimpor) announced a plan to increase its production capacity at the Jebel Oust plant to 2.4 Mt/yr from 1.6 Mt/yr by building an additional clinker production line (Global Cement Magazine, 2008). Bina Holding of Tunisia and Global Investment House (GIH), which was a Kuwaiti investment company, agreed to establish Carthage Cement as a greenfield cement plant with a production capacity of 2 Mt/yr. GIH acquired one of the largest quarries in North Africa. The quarry, which is located 25 kilometers (km) from the capital city of Tunis, covers a 2.2-square-kilometer (km^2) area and has 0.3 km^2 of gravel quarries under production as well as an estimated 250-Mt limestone deposit (Gulf News, 2008).

Phosphate Rock.—CPG extracted 11.6 Mt of raw phosphate in 2008 compared with 12.3 Mt in 2007. The combined output of the Jallabia, the Kef Eddour, and the Kef Eschfaier Mines accounted for 66% of the total phosphate rock extracted in Tunisia in 2008. The remaining 34% was produced at the Metlaoui, the Mzida, the Oum Laraies, and the Redeyef Mines. In 2008, about 879,000 t of phosphate rock was exported. The volume of phosphate rock exports in 2008 was 29% less than the 1.2 Mt exported in 2007. Despite the significant decrease in the volume of phosphate rock exports, income from phosphate rock exports in 2008 was more than that of 2007 because of a 250% increase in phosphate rock prices on the international market, which reached $146 per metric ton. Group Chimique Tunisienne (GCT) [Tunisian Chemical Group], which was the fertilizer manufacturing entity of CPG, processed phosphate rock at its four industrial sites in Gabes, M'Dhilla, Sfax, and Skhira.

In 2008, Tunisian Indian Fertilizers S.A. (TIFERT) awarded Technip S.A. of France a contract to build a sulfuric acid plant at the town of Skhira, which is located near the Gulf of Gabes in mideastern Tunisia. TIFERT was established in 2007 as a joint venture of GCT (35% interest) and Indian companies Coromandel Fertilizers Ltd. (CFL), Gujarat State Fertilizers, and Chemicals Ltd. (GSFC) (15% interest each). TIFERT planned to use phosphate rock and sulfuric acid to produce 1.3 Mt/yr of phosphoric acid for subsequent fertilizer production. Phosphoric acid production at the $165 million project was expected to begin in 2010 (Express India, 2008; Technip S.A., 2008).

Salt.—In 2008, marine salt production increased by 14% following a 17% decrease in 2007. More than 80% of the salt output was produced by Government-owned Compagnie Générale des Salines de Tunisie (COTUSAL) [Tunisia Salt Co.], and the remaining 20% was produced by private producers. Total salt exports were about 1 Mt and domestic salt sales were 107,000 t (Central Bank of Tunisia, 2009, p. 64).

Mineral Fuels

Natural Gas.—The output of dry natural gas in Tunisia in 2008 decreased by about 7% compared with that of 2007. The decrease was attributed to the maintenance-related stoppage of production at the Miskar gasfield and to the delay in the start of gas production at the Chergui field. The gas royalty,

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which the Government earned from the passage of the Trans Mediterranean gas pipeline through its land and territorial waters, was 10% more than the royalty received in 2007 (Central Bank of Tunisia, 2009, p. 67).

In August 2008, Petrofac Ltd. of the United Kingdom commenced first gas production from the Chergui offshore field, which is located 30 km from the city of Sfax. ETAP held 55% interest in the field as a development partner and Petrofac, which was the operator, held 45% interest. The natural gas would be delivered by way of a 57-km pipeline to the onshore facility of Société Tunisienne de L'Electric et du Gaz [Tunisian State Gas and Electricity Co.]. Natural gas production from the Chergui field was expected to be about 207 million cubic meters per year for a minimum of 4 years (Petrofac Ltd., 2008).

Petroleum.—In 2008, petroleum production was about 10% less than the record production reported in 2007, which was a record increase of 39% compared with the level of increase for the previous year; the output in 2008 was still greater than that achieved in 2005 and 2006, however. The decrease in crude output in 2008 was attributable to decreased production from the Oudna (a 73% decrease), the Didon (29%), and the Adam (14%) oilfields; however, output increases were reported at the Hajeb Guebibia (a 69% increase), the Oued Zar (23%), and the Ashtart (3%) fields. The output of the Cherouq field in 2008 increased to about 2.5 million barrels per year from 30,000 barrels per year in 2007 (Central Bank of Tunisia, 2009, p. 64, 66).

Pioneer Natural Resources Tunisia Ltd., which was a subsidiary of Pioneer Natural Resources Co. of the United States, owned an interest in five blocks covering about 12,000 km^2 of the Ghadames Basin located south of Tunisia. Pioneer was the operator of the the Anaguid and the Cherouq Blocks. The company conducted exploration activity at the Adam, the Anaguid, the Borj El Khadra, and the Cherouq Blocks. Pioneer produced about 2.3 Mbbl of oil and 24.5 million cubic meters of gas in 2008 (Pioneer Natural Resources Co., 2009, p. 28).

In 2008, the 50-50 joint venture of ETAP and OMV A.G. drilled for gas and oil at the Jenein Sud exploration permit, which is located in southern Tunisia. The joint venture reported condensate and natural gas discoveries at its Ahlem-1 and Sourour-1 exploration wells (OMV A.G., 2008).

Qatar Petroleum International (QPI), which signed an agreement with the Government in 2007 to build a new 140,000-barrel-per-day-capacity oil refinery at Skhira near the Gulf of Gabes, withdrew from the project. Petrofac was mentioned as a potential successor for QPI as a builder and operator of the planned refinery. La Société de Transport des Hydrocarbures par Pipelines (Sotrapil), which was the Government's pipeline oil transport company, called off a planned project to build a pipeline that was proposed to carry refined oil from the Bizerte refinery on the northern coast of Tunisia to an existing pipeline that links the Sidi El Kilani oilfield with Skhira oil terminal (Middle East Economic Digest, 2007; Hadfield, 2008; Alexander's Gas & Oil Connections, 2009).

Outlook

Tunisia's mineral industry is expected to continue to play an important role in the country's economy and to account for a significant share of its exports. Phosphate rock and phosphate-based products are expected to be the main exports of the chemical and mining industries. The proposed increase in the production capacity of the iron and steel industry is expected to meet the growing demand for steel products by the local market. The Government will likely continue to give incentives to attract international investment in the hydrocarbon sector; however, the success of these policies will depend on the hydrocarbon prices in the world markets.

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TABLE 1
TUNISIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Iron and steel:						
Iron ore:						
Direct shipping ore and concentrate, gross weight		256	206	214	180	211
Fe content[e]		134	108	112	94	110
Metal:						
Steel , crude		70 r	66 r	68 r	61 r	82
Concrete-reinforcing bars		258	441	501	454	421
Lead, mine output, Pb content	metric tons	5,470	8,708	--	--	--
Silver, metal, primary[e]	kilograms	2,400	1,200	--	--	--
Zinc:						
Concentrate, gross weight	metric tons	52,747	29,412	--	--	--
Zn content	do.	29,011	15,889	--	--	--
INDUSTRIAL MINERALS						
Barite	metric tons	1,813	--	--	--	--
Cement, hydraulic:						
Gray		6,485	6,358	6,599	7,052	7,559
White		204	333	333	327 r	316
Total		6,689 r	6,691	6,932	7,379 r	7,875
Clays:						
Common		5,140 r	5,310 r	5,380 r	5,550 r	5,800
Mosaic tile	thousand square meters	19,750	21,000	22,500	22,500	23,000
Earthenware tile	do.	15,100	15,690	15,900	16,300	17,500
Fertilizers:						
Ammonium nitrate		134	149	153	25 r	124
Compound fertilizers		32	28	15	25	23
Diammonium phosphate		1,314	1,115	1,093	1,008	1,017
Dicalcium phosphate		73	100	66	88	72
Hyperphosphate		21	30	26	31	36
Phosphoric acid		1,241	1,217	1,181	2,374 r	2,113
Sodium tripolyphosphate		126	141	142	143	112
Triple superphosphate		868	848	800	806 r	863
Fluorine, aluminum fluoride		42	42	43	42 r	43
Gypsum[e, 3]		109 r	113	151	250 r	263
Lime		476	424	401	395	369
Phosphate rock, washed, gross weight		8,051	8,220	7,801	8,002 r	7,692
Salt, marine		1,117	1,132	1,127	933	1,063
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	2,298	2,343	2,136 r	2,036 r	2,042
Dry	do.	1,858	1,899	1,661 r	1,579 r	1,471
Petroleum:						
Crude	thousand 42-gallon barrels	25,700	26,200	25,200	35,100	31,732
Refinery products:						
Liquefied petroleum gas	do.	1,250	1,260	1,280	1,180	1,427
Gasoline	do.	3,317 r	2,073 r	1,775 r	1,465 r	1,350
Naphtha	do.	378	1,070	1,110	1,743	1,513
Distillate fuel oil	do.	3,220	3,600	3,780	4,140	4,110
Residual fuel oil	do.	3,960	4,060	4,020	4,320	4,450
Paraffin oil	do.	1,207	1,635	971	928	859
White spirit	do.	68	77	85	102	110
Total	do.	13,400 r	13,775 r	13,021 r	13,878 r	13,819

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through March 31, 2010.

[2]In addition to the commodities listed, a variety of crude construction materials (sand and gravel and stone) was produced, but available information is inadaquate to make reliable estimates of output.

[3]Does not include phosphatic gypsum (waste product) generated during fertilizer production.

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TABLE 2
TUNISIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Aluminum fluoride		Industries Chimiques du Fluor	Ghannouch, near Gabes	46
Cement:				
Portland		Société des Ciment d'Enfidha (Cementos Portland Valderrivas, S.A., 88%)	Enfidha	2,000
Do.		Société des Ciment de Jbel Oust (Cimentos de Portugal SGPS, S.A. (Cimpor), 100%)	Jbel Oust	1,600
Do.		Société des Ciment de Gabès (Secil-Companhia Geral de Cal e Cimento, S.A., 99%)	Gabes	1,100
Do.		Société des Ciment d'Oum el Kélil (Government, 100%)	Le Kef	970
Do.		Société des Ciment de Bizerte (Government, 100%)	Bizerte	840
Do.		Société des Ciments Artificiels Tunisiens (Colacem S.p.A., 100%)	Ben Arous	800
White		Société Tuniso-Andalouse de Ciment Blanc S.A. (Grupo Prasa, 100%)	Feriana	333 [2]
Fertilizer:				
Ammonium nitrate		Group Chimique Tunisienne (Government, 100%)	Ghannouch, near Gabes	330 [3]
Diammonium phosphate		do.	do.	1,300
Triple superphosphate		do.	M'Dhilla	465
Do.		do.	Sfax	330
Gypsum		Les Plâtres Tunisiens (Knauf Gips KG)	Maknassy	100
Iron and steel:				
Iron ore		Société de Djebel Djerissa (Government, 100%)	Djerissa Mine	107
Do.		do.	Tamera Mine	73
Steel, crude		Tunisian Steel Manufacturing Co. (El-Fouladh) (Government, 100%)	El Fouladh	200
Steel, rolled, bar and rod		Intermetal S.A. (Private, 100%)	Ben Arous	300
Natural gas	million cubic meters	BG plc, 100%	Miskar field	523
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and Perenco Ltd., 50%	Franig field	170
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	Oued Zar/Hammouda field	150
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%; Eni Tunisia B.V., 25%; Pioneer Natural Resources Co., 20%; Talisman Energy Inc., 5%	Adam field	130
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	El Borma field	80
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Petrofac Ltd., 45%	Chergui field	70
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	Djebel Grouz field	40
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and Perenco Ltd., 50%	Baguel/Tarfa field	40
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Winstar Resources Ltd., 45%	Sabria field	14
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Société MARETAP S.A., 45%	Ezzaouia field	10
Do.	do.	Lundin Petroleum A.B.	Zinnia field	2
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and British Gas Tunisia Ltd., 50%	Hasdrubal field	NA
Petroleum:				
Crude	thousand 42-gallon barrels	Eni Tunisia B.V., 25%; Pioneer Natural Resources Corp., 20%; Talisman Energy Inc., 5%	Adam field	6,500
Do.	do.	PA Resources A.B., 100%	Didon field	3,750
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and Société de Recherches et d'Exploitation des Pétroles en Tunisie (SEREPT), 50%	Ashtart field	3,550
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	El Borma field	3,345
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and Pioneer Natural Resources Co., 50%	Cheroug field	2,510
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	El Hajeb/Guebiba field	2,020
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	Oud Zar/Hammouda field	1,880
Do.	do.	Lundin Petroleum A.B., 40%; Atlantis Technology Service, 40%; Entreprise Tunisienne d'Activités Pétrolières (ETAP), 20%	Oudna field	1,470
Do.	do.	British Gas Tunisia Ltd., 100%	Miskar field	1,420
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Perenco Ltd., 49%	Franig field	780

See footnotes at end of table

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TABLE 2—Continued
TUNISIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Petroleum—Continued:				
Crude—Continued	thousand 42-gallon barrels	Ecumed Petroleum Corp., 75%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 25%	Al Manzah field	720
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Thyna Petroleum Services S.A., 49%	Cercina field	560
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Compagnie Tuniso-Koweitienne de Pétrole (CTKP), 45%	Sidi El Kilani field	460
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Société MARETAP S.A., 45%	Ezzouia field	430
Do.	do.	Lundin Petroleum A.B./EGEP	Sidi El Itayem field	390
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Thyna Petroleum Services S.A., 49%	El Ain/Gremda field	365
Do.	do.	Candax Energy Inc. and Ecumed Petroleum Corp., 74%, and PA Resources A.B., 24%	El Bibane field	350
Do.	do.	Winstar Resources Ltd.	Chouech Essaida field	300
Do.	do.	PA Resources A.B., 70%, and Société de Recherches et d'Exploitation des Pétroles en Tunisie (SEREPT), 30%	Douleb/Semmama field	190
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 55%, and Winstar Resources Ltd., 45%	Sabria field	183
Do.	do.	do.	Rhemoura field	170
Do.	do.	Eni Tunisia B.V., 50%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%	Djebel Grouz field	150
Do.	do.	do.	Larich field	130
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 50%, and Société de Développement du Permis du Sud (SODEPS), 50%	Debbech field	73
Do.	do.	do.	Nakhil field	60
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Perenco Ltd., 49%	Baguel/Tarfa field	65
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%	Mazrane field	45
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Circle Oil Plc, 49%	Beni Khalled field	40
Do.	do.	Petrofac Ltd., 55%, and Entreprise Tunisienne d'Activités Pétrolières (ETAP), 45%	Cherqui field	35
Do.	do.	Winstar Resources Ltd.	Sanrhar field	34
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Perenco Ltd., 49%	Baguel field	20
Do.	do.	Eni Tunisia B.V.	Abir field	10
Do.	do.	Winstar Resources Ltd.	Ec-chouech field	10
Do.	do.	Canadax Energy Inc., 80%	Robbana field	7
Do.	do.	Lundin Petroleum A.B.	Zinnia field	6
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 75%	Mahares field	1
Do.	do.	Entreprise Tunisienne d'Activités Pétrolières (ETAP), 51%, and Eni Tunisia B.V., 49%	Baraka field	NA
Do.	do.	Thani Tunisia El-Jem B.V.	EL Jem field	NA
Do.	do.	OMV A.G.	Jenein field	NA
Refined	do.	Société Tunisienne des Industries du Raffinage (Government, 100%)	Bizerte	12,775
Phosphate rock		Compagnie des Phosphates de Gafsa (CPG) (Government, 100%)	Kef Eddour Mine	1,500
Do.		do.	Kef Eschfaier Mine	2,300
Do.		do.	Jallabia Mining Center	1,300
Do.		do.	Metlaoui, Mzida, Redeye and Uom Laraies Mines	2,600
Do.		do.		
Phosphoric acid		Group Chimique Tunisienne (GCT) (Government, 100%)	Ghannouch, near Gabes	470
Do.		do.	Skhira	375
Do.		do.	M'Dhilla	183
Do.		do.	Sfax	131
Salt		Compagnie Générale des Salines de Tunisie (COTUSAL)	Sfax and Zarzis	800
Do.		SAIDA S.A.	Sebkhet Sidi El Heni	250

Do., do. Ditto. NA Not available

[1]Actual production may significantly exceed nominal capacity.

[2]Nominal capacity is 260,000 metric tons per year (t/yr).

[3]Does not include production capacity of 30,000 t/yr of explosives-grade ammonium nitrate.

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The Mineral Industry of Uganda

Harold R. Newman

Uganda's geology could possibly host diverse mineral resources. Interest in the country's potential for mineral development had been increasing since the Government made efforts to improve its mining and investment laws. The focus in the past had been mainly on industrial minerals. The Government was continuing with a 5-year Sustainable Management of Mineral Resources Project (SMMRP), which began in 2004 and was funded by the Asian Development Bank, the Government of Uganda, the Nordic Development Fund, and the World Bank at a cost of $42.7 million. The SMMRP touches on many aspects of mineral resource development, including airborne geophysical surveys, encouraging small-scale miners and artisanal operators to form groups and legalize operations, geologic fieldwork, and the strengthening of governance in mineral sector management. SMMRP will also support the establishment of environmental, geo-informational, and mineral-related databases (Muleme, 2008).

The Ministry of Energy and Mineral Development consists of four technical departments under one directorate. The four technical departments are the Energy Resources Department, the Geological Survey and Mines Department, the Petroleum Exploration and Production Department, and the Petroleum Supplies Department. The purpose of the Ministry is to provide policy guidance for the development and exploitation of the country's energy and mineral resources; acquire, process, and interpret technical data to establish the energy and mineral resource potential of the country; create an enabling environment to attract investment in the exploration, development, and utilization of energy and mineral resources; and inspect, regulate, monitor, and evaluate activities of private companies in the energy and mineral sectors so that the resources are developed, exploited, and used on a rational and sustainable basis (African Development Information, 2008).

Minerals in the National Economy

Uganda's resources of more than 50 minerals rank it among the countries in Africa that have large numbers of minerals. The country had many areas that were thought to have potential for the occurrence of minerals but that have remained relatively unexplored despite the country's long history of production. Exploration was expected to increase after completion of the SMMRP in 2009. The Kamwenge District in western Uganda has some of the richest mineral deposits in the country, including deposits of gold, lead, and limestone. Renewed exploration efforts were taking place in the western Rift Valley where it was thought that considerable hydrocarbon deposits might exist. Revenues of companies in the mining and quarrying sector were increasing at a rate of about 11% per year and a number of mining companies had taken up exploration and development licenses in the mining sector (Uganda Investment Authority, 2008).

The leaders of three African trading blocks—the Common Market for Eastern and Southern Africa (COMESA), the East Africa Community (EAC), of which Uganda is a member, and the Southern Africa Development Community (SADC), of which Uganda was awaiting membership—agreed to create a free trade zone of 26 countries that had a combined estimated gross domestic product of $624 billion. The three blocks were already well established in their own right but cover varying swaths of land and numbers of people. It was hoped that an agreement would ease access to markets within the region and end problems arising from several countries having membership in multiple groups. The agreement was expected to help intraregional trade, boost growth, and strengthen the block's bargaining power when negotiating international deals. The agreement would also lend its backing to joint infrastructure and energy projects in the zone (BBC News, 2008).

Production

Uganda produced cobalt, gold, iron ore, steel, and tungsten. Uganda also produced such industrial minerals as gypsum, kaolin and other clays, lime, salt, and vermiculite, and such building materials as cement, limestone, and pozzolanic materials. Most of Uganda's aggregate, cobalt, gold, and vermiculite production was exported; production of these commodities was dependant upon world market conditions. Production and consumption depended primarily on the domestic construction sector for cement, limestone, pozzolanic materials, and steel. Data on mineral production of Uganda are in table 1.

Structure of the Mineral Industry

Table 2 is a list of the major mineral industry facilities in Uganda. The table provides the location and production capacities of these facilities.

Commodity Review

Metals

Copper.—After about 32 years of near dormancy, a $200 million bid was made by A-Tec Industries of Austria to restart the Government-owned Kilembe Copper Mines at Jinja. A-Tec had set up a subsidiary in Uganda, A-Tec Industries (U) Ltd., which was to lead the company's efforts to tap into the natural resources in Eastern and Central Africa, starting with Uganda. The global economic crisis was not expected to affect the bid for Kilembe. When Kilembe was producing copper, the ore was transported by train to Jinja for smelting, but A-Tec stated that its plan was to build a plant in Kasese to do the preliminary processing and to transport some material by road. There was also a potential for recoverable cobalt and gold as coproducts from the copper ore (Magumba, 2008).

At yearend 2008, A-Tec started trial production at the smelter at Jinja. A-Tec signed a sublease to refurbish and operate the

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dilapidated smelter along with the Kilembe Copper Mines. An estimated 400 metric tons (t) of copper ore was stockpiled along with a quantity of copper slabs that would be recycled. A-Tec acquired the sublease for a period up to 2014 (Potosi, 2008).

Gold.—African Mineral Fields (a subsidiary of Magnus International Resources Inc. of the United States) was drilling at the Lugaz, Mukono project in central Uganda to confirm previous surveys that showed possible large gold deposits. The drilling program was investigating a 300-meter (m)- to 700-m-wide gold-in-soil anomaly for a distance of about 3.5 kilometers (km). African Mineral was also drilling its Mashonga project in southwestern Uganda. At Mashonga, the program targeted an open pit mine and artisanal workings where high-grade gold, together with high-grade palladium and platinum, were recorded. Additional drilling at Mashonga would target a 3-km- by 500-m-wide gold-in-soil anomaly located about 1 km east of the mine. African Mineral stated that it had recovered some very high-grade gold assays from the surface and from artisanal mine shafts at Mashonga (RedOrbit News, 2008).

The Government announced that commercial production of gold would begin by yearend 2008 at Kama in the central Mubende district by Anglo Uganda Corp. of the United Kingdom. The amount of gold the company would produce after startup was not reported. More than 500 kilograms (kg) of gold was estimated to be in the mining areas licensed to Anglo Uganda (CommodityOnline, 2008).

Grey Crown Resources Ltd. of Canada signed an agreement to acquire a 100% interest in Busitema Mining Cie. Ltd., which owned the Tira Mine. The mine is located in the Busia region within a geologic structure on the Lake Victoria Greenstone Belt. Busitema Mining had title to a mining lease of about 0.5 square kilometers (km^2) (Grey Crown Resources Ltd., 2008).

Tantalum and Tin.—After obtaining a mining and prospecting license, Ugaruss Trading House Ltd. of Russia was planning to start its initial operations in Uganda by yearend 2008. Ugaruss was issued two licenses to start mining in parts of Mbarara and in areas near the Uganda—Tanzania border. Ugaruss stated that there was potential for tantalite and tin minerals although the company declined to reveal quantities and locations of the deposits (Abdallah, 2008).

Industrial Minerals

Cement.—Hima Cement Industries Ltd. (a subsidiary of the Lafarge Group of France) started expansion works that would increase production from 350,000 metric tons per year (t/yr) to more than 830,000 t/yr by 2010. This expansion would increase Hima's ability to meet local demand and would cost an estimated $108 million. The plant's expansion could be a boom to Uganda's construction industry, which imports large quantities of expensive cement from Kenya (Ugee Uganda, 2008).

Tororo Cement Ltd. announced that it planned to invest $25 million to expand its production capacity. The investment would be made in two phases starting with expansion of the capacity of the raw mill, rehabilitation of the kiln, and optimization of cement and clinker production with the addition of a new packer. The second phase would entail construction of a new cement mill that would increase production capacity from 700,000 t in 2008 to 1 million metric tons (Mt) in 2012. This investment was expected to reduce the country's reliance on cement imports (Tororo Cement Ltd., 2008).

Phosphate Rock.—Phosphates are contained in the carbonates of eastern Uganda. Nilefos Minerals Ltd. of Belgium (a subsidiary of the Madhavani Group) was developing the $535 million Tororo mining project in the Osukuru Hills. Tororo had an estimated phosphate resource of 230 Mt and covered an area of 26 km^2. The operation would include an open pit mine and a factory for the processing of the apatite. A fertilizer production facility would be constructed alongside the apatite processing unit. A tailings dam and a water recycling plant would also be constructed (New Vision, The, 2008).

Mineral Fuels and Related Materials

Petroleum.—The Government lifted a ban on licensing new companies to explore for natural gas and petroleum after the approval of the national gas and oil policy, which was to guide the exploration and exploitation activities in the sector. The policy would guide the administration, regulation, and management and would present a basis for regulating and investing in the sector. The Government was expected to start licensing companies through a competitive bidding process. Forty companies had applied for exploration and production licenses and were vying for the remaining four exploration areas. At yearend 2008, petroleum reserves on the Ugandan side of the Lake Albert Rift Basin were estimated to be 1 billion barrels (Dow Jones and Company, Inc., 2008).

Tullow Oil plc of the United Kingdom was in the process setting up a small refinery, which would initially produce about 4,000 barrels per day (bbl/d) of oil, a part of which would be used to run a 5-megawatt (MW)-capacity thermal plant. The Government expected to reach full production of between 40,000 and 60,000 bbl/d of petroleum during the next 5 years. The Government was in the process of constructing roads and railway networks to link the oil region to the rest of the country (Rigzone.com, 2008).

Tullow announced a major discovery at the Giraffe-1 exploration well, which is located in the Butiaba region of Block 1. Data indicated a net reservoir thickness of 38 m, which was the largest encountered in the area in 2008. The well had excellent reservoir quality in all pay zones with moveable oil being recovered at surface. Giraffe-1 was the sixth successful test of the Victoria Nile fairway within the Lake Albert Rift Basin. Tullow had interests in three licenses in the Lake Albert Rift Basin—a 100% interest in Block 2 and a 50% interest in Blocks 1 and 3A. Blocks 1 and 3A were operated by Heritage Oil Ltd. of the United Kingdom, which held the other 50% interest (MBendi Information Services (Pty) Ltd., 2008).

The Government announced that it intended to develop its petroleum downstream by constructing a minirefinery to process petroleum products. The refinery would be located at Hoima, 250 km northwest of Kampala, and was expected to reduce the country's dependence on imported petroleum products. Uganda had been depending on the Kenya Petroleum Refinery in Mombasa, Kenya, for its petroleum products (Petrolworld, 2008).

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Heritage Oil announced a significant oil find at its Buffalo-1 exploration well in Block 1, in the Albert Basin, Uganda. The well has a gross hydrocarbon-bearing interval of about 123 m, with about 43 m of net hydrocarbon pay. The Buffalo discovery was considered by Heritage Oil to have the potential to be the largest field in Uganda and could exceed the discoveries in the Kingfisher field. A total of 17 wells had been drilled by Heritage Oil (Heritage Oil Ltd., 2008).

Uranium.—IBI Corp. of Canada announced that it was accelerating uranium exploration on the Mubende prospect after signing confidentiality agreements with two companies interested in assessing the Mubende property for possible joint participation in the property. One was a major global mining company with significant uranium interests; the other was a junior company with uranium interests. Names of the companies were not revealed (IBI Corp., 2008).

Outlook

Most of Uganda's cobalt, columbite-tantalite, gold, and vermiculite production will most likely continue to be exported; the outlook for these commodities depends heavily upon world market conditions. For cement, limestone, and pozzolanic materials, the outlook depends primarily upon the strength of the domestic construction sector. The aid provided to Uganda by the African Development Fund, the Nordic Development Fund, and the World Bank Group under the SMMRP will continue to assist the country in increasing production and tax revenues from its mining sector. The continued unreliability of power supplies is expected to pose difficulties for mining and mineral processing operations. Exploration for petroleum is expected to continue to be strong, and the sector will likely continue to develop.

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TABLE 1
UGANDA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007[e]	2008[e]
Beryllium, mine output, Be content		25	2	--	--	--
Cement, hydraulic[e]		558,988 [3]	630,000	630,000	650,000	650,000
Clay:						
Kaolin		537	55	30	20	20
Other[e]		44,000	51,000	50,000	50,000	50,000
Cobalt, refined		436	638	689	698 [3]	663 [3]
Gold, mine output, Au content[4]	kilograms	1,447	46	22	20	20
Gypsum		181	285	121	125	125
Iron ore		--	209	208	200	200
Lime, hydrated and quick[e]		10,000	10,000	10,000	10,000	10,000
Limestone		228,776	540,756	425,611	450,000	450,000
Niobium (columbium) and tantalum, ore and concentrate:[5]						
Gross weight	kilograms	376	273	275	275	275
Nb content[e]	do.	170	130	130	130	130
Ta content[e]	do.	100	70	70	70	70
Pozzolanic material		134,644	138,933	213,640	200,000	200,000
Salt[e]		5,000	1,500	1,500	1,500	1,500
Steel[e]		30,000	30,000	30,000	30,000	30,000
Tin, mine output, Sn content		2	--	--	--	--
Tungsten, mine output, W content		52	45	94	75	75
Vermiculite		2,688	2,574	3,512	3,500	3,500

[e]Estimated; estimated data are rounded to no more than three significant digits. do. ditto. -- Zero.

[1]Table includes data available through July 31, 2009.

[2]In addition to the commodities listed, the following are presumably produced but information is inadequate to estimate output: corundum, lead, marble, sand and gravel, silica sand, and soapstone.

[3]Reported figure.

[4]Does not include smuggled artisanal production.

[5]The high level of production in 2004 and subsequent drop suggest the possibility of production from elsewhere outside the country.

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TABLE 2
UGANDA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Tororo Cement Industries Ltd.	Tororo	700,000
Do.		Hima Cement Industries Ltd. (Bamburi Cement Ltd., 70%)	Kasese	350,000
Cobalt, refined		Kasese Cobalt Company Ltd. (Blue Earth Refineries Ltd., 75%, and Government, 25%)	do.	1,000
Gold	kilograms	Busitema Mining Company Ltd. (Grey Crown Resources Ltd.)	Tiira Mine near Busia	400
Lead, refined secondary		Uganda Batteries Ltd.	Kampala	1,000
Niobium (columbium) and tantalum	kilograms	M/S Technical Support and Services Ltd.	Wampewo	11,000 e
Steel:[1]				
Crude[2]		Steel Corp. of East Africa Ltd. (subsidiary of Madhvani Group)	Jinja	25,000
Do.		Steel Rolling Mills Ltd. (subsidiary of Alam Group Ltd.)	do.	21,000
Billet[2]		Steel Corp. of East Africa Ltd. (subsidiary of Madhvani Group)	do.	60,000
Rolled[2]		do.	do.	101,200
Do.		Steel Rolling Mills Ltd. (subsidiary of Alam Group Ltd.)	do.	40,000
Do.		BM Technical Services Ltd.	Mbarara	20,000
Do.		Sembule Steel Mills Ltd.	Kampala	20,000
Stone, crushed		Hima Cement Industries Ltd.	Kasese district	NA
Do.		Kilembe Mines Ltd.	do.	NA
Do.		Tororo Cement Industries Ltd.	Tororo district	NA
Do.		Zzimwe Construction Ltd.	Mukono district	690,000
Soapstone		African Minerals Ltd.	Moroto	NA
Tungsten[2]		Krone Uganda Ltd.	Nyamurilo	115
Vermiculite		Canmin Resources Ltd. (subsidiary of International Business Investments Corp.)	Namekara	25,000

[e]Estimated. Do., do. Ditto. NA Not available.
[1]In addition to its crude, billet, and rolled steel facilities, Uganda has a galvanized steel plant with a capacity of 30,000 metric tons per year.
[2]Not operating in 2005; more recent information is not available.

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The Mineral Industry of Zambia

By Philip M. Mobbs

Copper mining and refining were the predominant components of Zambia's mineral industry. Zambia also was a significant producer of cobalt and semiprecious gemstones, such as amethyst, beryl, and emerald. In 2008, Zambia's mines accounted for an estimated 9% of total world cobalt output and 4% of world copper production (Edelstein, 2010; Shedd, 2010).

Minerals in the National Economy

In 2008, mining and quarrying accounted for about 8.2% of the real gross domestic product (at constant 1994 prices) compared with 8.5% in 2007. The decline was attributable to the diversification of the economy. According to provisional data, exports of cobalt and refined copper (which may include plate, sheet, strip, and wire) were valued at $3.4 billion in 2008 and accounted for 70% of Zambia's merchandise exports. Exports of other minerals and mineral-based commodities, such as cement, gemstones, lime, and magnesium, accounted for slightly more than 1% of merchandise exports (Central Statistical Office, 2008a, p. 6; b, p. 6; c, p. 6; d, p. 6-7; e, p. 6; f, p. 6; g, p. 6-7; h, p. 6; i, p. 6-7; j, p. 6-7; 2009a, p. 5; b, p. 7; Bank of Zambia, 2009, p. 35).

Government Policies and Programs

In 2008, significant new legislation concerning the mineral sector was implemented. The mining sector is regulated by Act No. 7 of 2008 [the Mines and Mineral Development Act of 2008], which replaced the Mines and Mineral Act No. 31 of 1995 and amendments. The new mining law calls for a 30% corporate tax on income, a 5% royalty on the gross value of gemstones, a 5% royalty on the "norm" value of precious metals [one of the law's three definitions of the norm value is the monthly average London Metal Exchange (LME) cash price per metric ton multiplied by the quantity of the metal or recoverable metal sold (§133, paragraph 3a-b)], a 3% royalty on the "norm" value of base metals, a 3% royalty on the gross value of industrial minerals, and a variable profit tax of up to 15% on taxable income; the new law also increases the value-added-tax refund period for exploration companies to 7 years. Previously, mining companies with large-scale mining projects had negotiated separate development agreements with the Government that specified fiscal and taxation provisions for the projects. Companies in the mineral industry had been subject to a corporate income tax rate that ranged from 15% to 25%. The old royalty rate had been 2% of the free-on-board market value of produced minerals that was reduced by the cost of handling and transport and the cost of smelting and refining (Government of Zambia, 2008b; Mwale, 2009, p. 13-14).

The new mining law also introduces a controversial windfall tax on value of produced base metals. The windfall tax rate is pegged at 25% when the realized price of copper sold is between about $5,512 per metric ton (specified as $2.50 per pound) and $6,614 per metric ton ($3.00 per pound), 50% for copper prices between $6,614 per metric ton and $7,716 per metric ton ($3.50 per pound), and 75% for copper prices that exceed $7,716 per metric ton. In 2008, the average price of LME grade A copper cathode was $6,945 per metric ton ($3.15 per pound) compared with $7,121 per metric ton ($3.23 per pound) in 2007. By yearend 2008, the LME price of copper was $2,902 per metric ton, which was well below the windfall tax threshold. The decline was attributable to the global economic crisis (Government of Zambia, 2008b; Edelstein, 2010).

Investment in most types of mineral operations are covered by the Zambia Development Agency Act of 2006, although minerals produced for the construction industry, such as clay, sand, and most types of stone, are excluded. Act No. 2 of 2008 [the Customs and Exercise Act (amendment) of 2008] introduces a 15% export duty on the value of cement copper, copper ores and concentrates, and copper anodes. For exported ferrous scrap, a 25% levy is due on the value per kilogram [or 80,000 kwacha (about $21) per kilogram, whichever is greater]. For aluminum scrap, copper scrap, and zinc scrap, a 25% levy is charged on the value per metric ton [or 1,000,000 kwacha (about $262) per metric ton, whichever is greater] (Government of Zambia, 2008a).

The Environmental Protection and Pollution Control Act of 1990 and its 1999 amendment address environmental issues, including those associated with the mining industry. Petroleum exploration and production are regulated by Act No. 10 of 2008 [the Petroleum (Exploration and Production) Act of 2008], which replaced Petroleum (Exploration and Production) Act No. 13 of 1985 and amendments.

In mid-2008, the Government resumed issuing mining exploration licenses. The issuance of licenses had been suspended in 2007 owing to the introduction of a digitized and reorganized cadastre system that detailed the location, ownership, and tenure of licensed mineral exploration and mining activities.

Production

The increase in production of copper sulfide ore at First Quantum Minerals Ltd. of Canada's Kansanshi Mine resulted in a notable increase in copper concentrate and increased gold and silver doré. Production of refined cobalt, however, decreased significantly in 2008. Data on Zambian mineral production are in table 1.

Structure of the Mineral Industry

Many of the country's large mining operations are located in Copperbelt Province in north-central Zambia. The Government retains minority interest in most of the large copper projects through its Zambia Consolidated Copper Mines Investments Holdings Plc. The mining sector is administered by the

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Geological Survey Dept., the Mines Development Dept., and the Mines Safety Dept. of the Ministry of Mines and Minerals Development. The Ministry of Commerce, Trade and Industry oversees the industrial manufacturing sector. Copperbelt Energy Corporation Plc, which purchased most of its power from state-owned ZESCO Ltd., distributed electrical power to many of the larger mining operations.

In 2008, Vedanta Resources plc of the United Kingdom acquired Zambia Copper Investments Ltd.'s 28.4% interest in Konkola Copper Mines plc, which brought Vedanta's interest in Konkola to 79.4%. Data on the capacity and ownership of selected mineral operations are in table 2.

Commodity Review

In January, a national failure of the electricity power grid adversely affected the mines and mineral processing facilities in Zambia. Some miners initially were trapped underground owing to the lack of electricity to power the mine winders, which also stopped the lifting of ore to the surface. Failure to power ventilation fans adversely affected the underground working environment. Also, other electricity-powered equipment, such as pumps, were damaged, which resulted in partial flooding of some mines. Most mines, however, resumed normal activity within 2 to 3 weeks (Shacinda, 2008b).

A number of exploration projects for cobalt, copper, gold, and uranium continued in 2008. Companies with exploration projects in Zambia included Africa Eagle Resources plc of the United Kingdom on the Sasare Eagle Eye copper gold prospect and the Lunga copper, gold, and uranium prospect. In 2008, Phelps Dodge Mining Ltd. of the United States withdrew from the Ndola copper prospect joint venture with African Eagle. African Eagle increased its interest in the Mokambo copper prospect joint venture to 87% when partner Copperbelt Minerals Ltd. of the United Kingdom reduced its interest to 13% from 50%. CGA Mining Ltd. of Australia completed a prefeasibility study on the Mkushi copper prospect. Joint-venture partner African Eagle and CGA subsequently decided to postpone the decision to develop the project owing to the decline in copper prices and global market conditions (African Eagle Resources plc, 2009).

Companies with exploration activity also included African Energy Resources Pty. Ltd. and Albidon Ltd. of Australia on the Chirundu joint-venture uranium project; African Energy also agreed to an option to acquire 51% interest in Aldershot Resources Ltd.'s Kariba uranium project; Allied Energy Corp. of the United States evaluated the Starfield tin mine; the joint venture of the BHP Billiton Group and Blackthorn Resources Ltd. of Australia (formerly AIM Resources Ltd.) explored the Mumbwa copper and gold project; and Caledonia Mining Corp. of Canada explored the Nama cobalt project. Based on the results of a National Instrument 43-101 technical report, ICS Copper Systems Ltd. of Canada abandoned the option that it held on its Mokambo copper project, which was located in the central Mokambo area (ICS Copper Systems Ltd., 2009, p. 2).

Other exploration activity included the following: Kiwara PLC of the United Kingdom evaluated the Kawanga uranium and the Kwako nickel prospects; the joint venture of Kiwara and LM Engineering Ltd. worked cobalt-copper-nickel prospects and an iron ore deposit on the Kalumbila prospect; Luiri Gold Ltd. of Canada drilled the Luiri Hills gold project (which included the Dunrobin and the Matala Dome deposits); and OmegaCorp Minerals Ltd. of Australia, which was a subsidiary of Denison Mines Corp. of Canada, drilled the Mutanga uranium project. Because of the Government's suspension of new exploration licenses, Red Rock Resources plc of the United Kingdom deferred work on the Chiwefwe manganese prospect in 2008.

In 2008, Teal Exploration & Mining Inc. of Canada [in which African Rainbow Minerals Ltd. of South Africa (ARM) held 65% interest] acquired the 30% joint-venture interest in the Mwamabashi copper project that was formerly held by Korea Zinc Company Ltd. Teal continued its evaluation of the Konkola North copper project and formed a joint venture with Antofagasta Minerals SA to evaluate exploration areas 2 and 4. At yearend, ARM proposed to acquire 100% of Teal's shares and to form a joint venture with Companhia Vale do Rio Doce S.A. to explore in the Democratic Republic of the Congo [Congo (Kinshasa)], Namibia, and Zambia.

Zambezi Resources Ltd. of Bermuda explored the Kangaluwi copper project. Zambezi evaluated the Cheowa copper project joint venture with Glencore International AG of Switzerland and the Mpande and the Oryx uranium prospects with joint-venture partner Lithic Metals and Energy Ltd. In November, Zambezi agreed with creditors to a 4-month suspension of operations in order to restructure the company's finances (Zambezi Resources Ltd., 2008).

Metals

Cobalt.—Chambishi Metals Plc suspended operations at the Chambishi cobalt smelter in early December. Chambishi Metals, which was a sister company of Luanshya Copper Mines Ltd., cited the decline in metal prices as a contributing factor for the closure (Shacinda, 2008a; Zambian Chronicle, 2009).

Copper.—In 2008, First Quantum commissioned the sulfide-ore-treatment-capacity-expansion project at the Kansanshi Mine, which increased the mine's sulfide ore throughput to more than 12 million metric tons per year (Mt/yr) from a capacity of 8 Mt/yr. The Kansanshi Mine was also able to process 6 Mt/yr of oxide ore. In 2008, 19.1 million metric tons (Mt) of ore and 28.7 Mt of waste were mined at Kansanshi compared with 15.5 Mt of ore and 24.9 Mt of waste in 2007. The Kansanshi solvent extraction-electrowinning (SX-EW) plant produced 102,353 metric tons (t) of copper cathode in 2008 compared with 93,249 t in 2007 (First Quantum Minerals Ltd., 2009, p. 4, 22).

The Bwana Mkubwa SX-EW plant posted a 77% decrease in output to 5,851 t of copper cathode in 2008 from 25,402 t in 2007. Bwana Mkubwa, which had processed copper ore from First Quantum's Lonshi Mine in Congo (Kinshasa) until the border was closed to shipments of copper ore in November 2007, was placed on care-and-maintenance status in October 2008. The Lonshi Mine continued to operate until August 2008, when the mine was closed because of the exhaustion of ore reserves; the ore mined from November 2007 until August 2008 remained stockpiled in Congo (Kinshasa) (First Quantum Minerals Ltd., 2009, p. 5, 9, 24).

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Konkola Copper Mines plc produced 132,000 t of copper cathode in 2008 compared with 153,000 t in 2007. The January national electrical power failure, lower copper prices, and the diverting of copper concentrate to the new Nchanga smelter (as it was ramped up to capacity) from the old Nchanga smelter contributed to the decline in copper production. Work continued on the Konkola deeps mining project; initial production was postponed until early 2010 (Vedanta Resources plc, 2008; 2009, p. 3).

In November, because of the decline in copper prices, LCM suspended the development of the Mulyashi Mine, which had been expected to start production in early 2009. In late December, LCM placed the Baluba copper mine on care-and-maintenance status and Chambishi Metals Plc suspended operations at the Chambishi copper roaster (Shacinda, 2008a).

In July, a fire damaged the main electrical transformer and substation, which delayed the commissioning of the Lumwana Mine that was operated by Equinox Minerals Ltd. of Australia. Contractors completed the Lumwana processing facilities in November, and in December, Equinox produced its initial concentrate. Equinox expected to ramp the project up to full capacity (20 Mt/yr of ore from which concentrate containing 172,000 t of copper would be produced) by mid-2009 (Equinox Minerals Ltd., 2009, p. 11-12).

Nickel.—In early 2008, Albidon Ltd. of Australia began mining at the Munali nickel mine, which was located about 60 kilometers (km) south of Lusaka. At midyear, Albidon started producing a nickel concentrate that also contained cobalt, copper, and platinum-group metals. By yearend, the company had mined 270,376 t of ore to produce 10,911 t of concentrate that had an average grade of 6.88% nickel (about 751 t of nickel contained in the concentrate). Mine output had been adversely affected by the problems with underground mining equipment and delays in the receipt of replacement parts (Albidon Ltd., 2009, p. 1).

Industrial Minerals

Cement.—Chilanga Cement plc, which was a subsidiary of Lafarge S.A. of France, inaugurated a new cement plant. The 830,000-metric-ton-per-year-capacity plant was located about 15 km south of Lusaka, adjacent to the older plant at Chilanga (Lafarge S.A., 2008).

Sinoma International Engineering Co. Ltd. of China was contracted to build a cement plant in Zambia for the Dangote Group of Nigeria. The proposed 3,000-metric-ton-per-day-capacity plant was to be located near Lusaka (Ahemba, 2008; China Knowledge, 2009).

Outlook

Zambia has many deposits and occurrences of metals; historically, the country's mining industry has been dominated by the copper sector. Landlocked Zambia faces several internal and external obstacles to successful and sustained mineral resource development; these include cyclical world commodity prices; high transportation costs; limited national infrastructure, particularly west of the Copperbelt; the cost of imported equipment and supplies; potential disruptions of electrical energy and fuel supplies, and the threat that high HIV/AIDS rates in the region pose to maintaining a skilled labor force.

The surge in international mineral prices during the past few years has increased investor interest in exploration for and development of economic deposits of metal, such as cobalt, copper, gold, manganese, nickel, and zinc; industrial minerals and mineral-related commodities, especially cement, semiprecious gemstones, and sulfuric acid; and mineral fuels and related materials, such as petroleum and uranium. The dramatic decline in international mineral prices (especially copper and nickel) in late 2008, compounded by the effects of the newly-introduced increase in taxes (especially the windfall tax), is expected to adversely affect the short-term economic viability of Zambia's mineral industry.

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TABLE 1

ZAMBIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Cobalt:						
Mine output, Co content		10,000	9,300	8,000	7,500 r	6,900
Metal, Co content		5,791 [3]	5,422 [3]	4,665 [3]	4,335 r, [3]	2,591
Copper:[4]						
Mine output, Cu content:						
By concentration or cementation		344,300 [3]	341,000	370,000	340,000 r	383,000
Leaching, electrowon		82,600 [3]	106,000	144,000	216,000 r	200,000
Total		426,900 [3]	447,000	514,000	556,000 r	583,000
Metal:						
Smelter, primary, includes low-grade electrowon		280,100 [3]	270,000	290,000	224,000 r	230,000
Refinery, primary:						
Electrowon		124,000	155,000	178,000	160,000 r	163,000
Other		286,000	244,000	240,000	230,000 r	240,000
Total		410,000	399,000	418,000	390,000 r	400,000
Gold	kilograms	--	440	956	1,270	1,930
Lead, metal, secondary		1,000	1,000	1,000	1,000	1,000
Manganese:						
Gross weight		--	--	--	1,400	1,500
Mn content		--	--	--	644	700
Silver	kilograms	--	2,000	3,000 r	3,500 r	4,000
INDUSTRIAL MINERALS						
Cement		390,000	435,000	650,000	650,000	700,000
Clays:						
Brick		3,300	3,300	3,300	3,300	3,300
Building, not further specified		33,000	33,000	33,000	33,000	33,000
China and ball		200	200	200	200	200
Gemstones:						
Amethyst	kilograms	1,100,000	1,100,000	1,200,000	1,200,000	1,100,000
Beryl	do.	8,000	10,000	10,000	10,000	9,200
Emerald	do.	2,100	2,500	2,600	2,500	2,300
Tourmaline	do.	26,000	26,000	27,000	27,000	25,000
Lime, calcined	thousand metric tons	150	150	150	150	150
Limestone:						
For cement and lime	do.	750	750	1,200	1,200	1,300
Crushed aggregate	do.	650	650	700	700	700
Sand and gravel, construction	do.	220	220	300	300	300
Sulfur:						
Gross weight:						
Pyrite concentrate		280,000	285,000	290,000	290,000	290,000
Sulfuric acid[5]		12,000	12,000	15,000	15,000	15,000
Sulfur content:						
Pyrite concentrate (42% S)		118,000	120,000	122,000	123,000	123,000
Sulfuric acid (32.6% S)		3,910	3,910	4,890	4,900	4,900
Total, S content		122,000	124,000	127,000	128,000	128,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		240,000	240,000	210,000	220,000	220,000
Petroleum, refinery products	thousand 42-gallon barrels	6,200	5,000	5,000	4,400	4,500

rRevised. do. Ditto. -- Zero.

[1]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through February 4, 2010.

[3]Reported figure.

[4]Terms used are as defined by the International Copper Study Group.

[5]From the Chambishi and the Nkana acid recovery plants.

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TABLE 2
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Chilanga Cement plc (Lafarge S.A., 84%)	Lusaka and Ndola plants	700,000.
Do.	do.	New plant at Lusaka	830,000.
Do.	Zambezi Portland Cement Ltd.	Ndola	330,000.[1]
Coal, bituminous	Maamba Collieries Ltd. (Government, 100%)	350 kilometers south of Lusaka in the Kanzie and the Izuma Basins	800,000.
Do.	Collum Coal Mining Industries Ltd.	Near Sinazongwe	200,000.
Copper and cobalt:			
Ore and concentrate	Lumwana Mining Company Ltd. (Equinox Minerals Ltd., 100%)	Lumwana Mine (Malundwe pit)	20,000,000 ore.
Do.	Kansanshi Mining plc (Kansanshi Holdings Ltd.,[2] 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Kansanshi Mine, north of Solwezi	12,000,000 sulfide ore, 6,000,000 oxide ore.
Do.	Konkola Copper Mines plc (Vedanta Resources plc., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Nchanga open pit	4,500,000 ore.
Do.	do.	Nchanga underground mine	2,800,000 ore.
Do.	do.	Konkola Mine, Chililabombwe	2,400,000 ore.
Do.	do.	Fitwaola open pit	NA.
Do.	Mopani Copper Mines plc (Carlisa Investments Corp.,[3] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Nkana Mine	5,500,000 ore.
Do.	do.	Mufulira Mine	2,500,000 ore.
Do.	Luanshya Copper Mines Ltd. (Enya Holdings BV,[4] 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 15%)	Baluba underground mine	1,400,000 ore.[5]
Do.	NFC Africa Mining plc (China Nonferrous Metal Mining Corp., 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 15%)	Chambishi Mine	800,000 ore, which yields about 50,000 copper in concentrate.
Do.	Chibuluma Mines plc (Metorex Ltd., 65%, and Industrial Development Corp. of South Africa Ltd., 35%)	Chibuluma South Mine, about 20 kilometers from Kitwe	600,000 ore, which yields about 14,000 copper in concentrate.[6]
Do.	Albidon Ltd.	Munali nickel mine, about 60 kilometers south of Lusaka	1,200,000 ore, which yields about 1,700 copper and 500 cobalt coproduct.
Metal	Konkola Copper Mines plc (Vedanta Resources plc., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Tailings leach plant at Chingola	80,000 copper cathode.
Do.	KCM (Smelterco) Ltd. (Vedanta Resources plc., 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Nchanga copper smelter	500,000 copper anode (blister copper).
Do.	do.	Nkana copper smelter	240,000 copper anode (blister copper).
Do.	do.	Nkana copper refinery	180,000 copper cathode.
Do.	Mopani Copper Mines plc (Carlisa Investments Corp.,[3] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Mufulira in situ leach and SX-EW[7] plant	17,000 copper cathode.
Do.	do.	Mufulira (ISASMELT) smelter[8]	200,000 copper anode.
Do.	do.	Mufulira refinery	275,000 copper cathode.
Do.	do.	Nkana heap leach	38,000 copper cathode.
Do.	do.	Nkana cobalt refinery	2,500 cobalt metal.

See footnotes at end of table.

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TABLE 2—Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper and cobalt—Continued			
Metal—Continued	Chambishi Metals plc (Enya Holdings BV,[4] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Chambishi cobalt plant and Nkana slag dump	27,000 copper cathode, 7,000 cobalt metal.[5]
Do.	First Quantum Minerals Ltd.	Bwana Mkubwa SX-EW[6] plant, which treats ore from the Lonshi Mine, Congo (Kinshasa)	52,000 copper cathode.
Do.	Sable Zinc Kabwe Ltd. (Metorex Ltd., 100%)	Sable copper leach and electrowinning plant at Kabwe treats feed imported from concentrates produced from the Ruashi stockpiles, Congo (Kinshasa)	14,000 copper cathode, 300 cobalt carbonate.
Do.	Sino-Metals Leach Zambia Ltd. (China Nonferrous Metals Mining Co. Ltd., Sino-Africa Mining Investments Ltd., NFC Africa Mining Plc, and China Hainan Construction Co. Ltd.)	Chambishi	8,000 copper cathode.
Do.	Triple Plate Junction Smelting Ltd. (Triple Plate Junction Plc, 90%)	Ndola copper smelter	800 copper anode.
Gold, content of ore kilograms	Kansanshi Mining plc (Kansanshi Holdings Ltd.,[2] 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Kansanshi Mine	1,000.
Lime, quicklime	Ndola Lime Company Ltd. (Zambia Consolidated Copper Mines Investment Holdings Plc, 100%)	Ndola	300,000.[9]
Lead, metal, secondary	Pagrik Zambia Ltd. (Gravita Group, 100%)	Lusaka	1,000.
Manganese	Small-scale miners	Luapula	250.
Nickel, Ni content of ore	Albidon Ltd.	Munali Mine, about 60 kilometers south of Lusaka	10,500.
Petroleum, refined 42-gallon barrels	Indeni Petroleum Refinery Ltd. (Total Outre Mer, 50%, and Government, 50%)	Indeni refinery at Ndola	3,500,000.
Sulfur:			
Pyrite ore, gross weight	Konkola Copper Mines Plc	Nampundwe Mine, 48 kilometers west of Lusaka	300,000.
Sulfuric acid	do.	Nkana No. 3 and No. 4 acid plants	380,000.
Do.	do.	Nchanga acid plant	180,000.
Do.	First Quantum Minerals Ltd.	Bwana Mkubwa acid plant	350,000.

Do., do. Ditto. NA Not available.
[1]Under construction.
[2]Subsidiary of First Quantum Minerals Ltd.
[3]Carlisa Investments Corp. is owned by Glencore International AG, 81.2%, and First Quantum Minerals Ltd., 18.8%.
[4]Enya Holdings BV is owned by International Mineral Resources AG and Beny Steinmetz Group Resources.
[5]Suspended.
[6]Also includes some cobalt content.
[7]Solvent extraction-electrowinning.
[8]Construction of the ISASMELT smelter that had a copper-in-concentrate input capacity of 720,000 metric tons per year (t/yr) was completed at Mufulira, and commissioning began in late 2006. The ISASMELT smelter replaced the old smelter at Mufulira that had an input capacity of 420,000 t/yr copper concentrate and an output capacity of 160,000 t/yr of copper anode.
[9]Plant has the capacity to produce up to 5,000 metric tons of hydrated lime (slaked) from quicklime.

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The Mineral Industry of Zimbabwe

By Philip M. Mobbs

Zimbabwe's diverse mineral output included about 3% of the world's chromite (much of which is used as a feed material for the ferroalloy plants in Zimbabwe) and platinum production, and about 2% of the world's asbestos, lithium, palladium, and vermiculite production. Rampant inflation continued to adversely affect Zimbabwe's mineral production operations in 2008. Companies that produced minerals or manufactured mineral-based commodities in Zimbabwe struggled to maintain operations (table 1; Mpofu, 2008; Cordier, 2010; Jaskula, 2010; Loferski, 2010; Papp, 2010; Virta, 2010).

Minerals in the National Economy

Of the approximately 30 minerals or mineral-based commodities produced in Zimbabwe, the platinum-group metals (PGM) remained the most economically significant. The mining sector accounted for about 4% of the gross domestic product (GDP). Minerals and mineral-based commodities were a significant segment of national exports. Despite the general increase in world mineral prices in early 2008, output of most mineral commodities in Zimbabwe continued to decline, restrained by frequent electrical power outages (which often resulted in damaged equipment or flooded mines); the lack of foreign currency to purchase imported equipment, spare parts, and supplies; political uncertainty; and chronic shortages of food, fuel, and skilled manpower (Banya, 2008; Makoshori, 2008c; Zimbabwean, The, 2008).

Government Policies and Programs

The Ministry of Mines and Mining Development manages the mineral sector in accordance with the Mines and Minerals Act (chapter 21:05) and the Mining (General) Regulations, 1977. The Gold Trade Act of 2006 mandates penalties for unlawful possession or trading of gold. The 2007 amendment of the Environmental Management Act of 2002 also affected mines.

The Empowerment and Indigenization Bill, which requires that 51% ownership of businesses in Zimbabwe be acquired by eligible Zimbabweans, was enacted in 2008. Regulations associated with the indigenization law were expected to be promulgated in 2009 or 2010.

The Government instituted price controls in 2007 that continued to adversely affect mineral-based commodity companies, such as brick, cement, coal, and fertilizer companies, that sold their production domestically. The Government's foreign exchange policy and chronically delayed payments from the Reserve Bank of Zimbabwe often adversely affected mining and mineral-based commodity companies that exported their mineral production. In May, the official Zimbabwe dollar (Z$) to United States dollar ($) exchange rate was revised to a floating rate of about Z$165,000,000=$1 from a fixed rate of Z$30,000=$1. After the official inflation rate reached 231,000,000% in July, the Government ceased to release consumer price index data. This action was taken owing to a lack of goods for purchase in stores. In August, the newly-issued Z$10,000,000,000 dollar bill was revalued to Z$1. Hyperinflation, which was estimated to have reached about 500,000,000,000% in September and 89,700,000,000,000,000,000,000% in November (compared with an average of 10,453% in 2007 and 1,017% in 2006) was finally dampened in late 2008 by the migration from the Zimbabwe dollar to foreign currencies (Financial Gazette, The, 2008; Hanke, 2008; Herald, The, 2008; International Monetary Fund, 2008, 2009; Mpofu, 2008; Ndlela, 2008; Pretoria Portland Cement Company Ltd., 2009, p. 14).

Production

Despite the shutdown of blast furnace no. 4 that was operated by Zimbabwe Iron and Steel Company (Private) Ltd. (Zisco), steel production was estimated to have increased owing to increased production from Steelmakers Zimbabwe (Private) Ltd. According to statistics released by the Kimberley Process (2008, 2009), diamond production in Zimbabwe significantly increased in 2008. Production of asbestos, coal, copper, gold, graphite, iron ore, lithium minerals, mica, nickel, nitrogen (ammonia), and silver were estimated to have decreased significantly in 2008.

Structure of the Mineral Industry

Ownership of mineral operations in Zimbabwe was dominated by domestic investment, domestic and international mining, and international cement companies. State-owned operating companies in the minerals sector included Zimbabwe Mining Development Corp. (ZMDC), which maintained equity interest in inactive copper mining and processing facilities, and in gold mines, many of which were inactive. ZMDC also nominally was assigned the Marange diamond mining operation in eastern Zimbabwe. Subsidiaries of state-owned Industrial Development Corp. of Zimbabwe Ltd. produced industrial minerals and mineral-based commodities, such as clay, fertilizers, glass, phosphate rock, and stone. Zisco, in which the Government held majority interest, operated a crude steel plant, and a Zisco subsidiary operated iron ore and limestone mines. Foreign investment was concentrated in the cement, chromium, coal, diamond, gold, nickel, PGM, and steel sectors.

Before the March 2008 parliamentary and presidential elections, numerous international mineral companies expressed interest in investing in the rehabilitation of Zimbabwe's mines, essentially speculating on Zimbabwe's expected economic rebound, especially if there was a change in Government policies (Magnowski, 2008; Makunike, 2008).

In 2008, because of the economic conditions and the decline in the market price of nickel, Bindura Nickel Corp. Ltd. suspended operations at the Shangani and the Trojan nickel mines and at the Bindura nickel smelter and refinery.

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Because of the economic conditions, Falcon Gold Zimbabwe Ltd. (Falgold) and Olympus Gold Mines Ltd., which were subsidiaries of Central African Gold Plc of the United Kingdom, placed the Camperdown, the Dalny, the Golden Quarry, and the Old Nic Mines on care-and-maintenance status. Mining operations at Falgold's Venice gold mine remained suspended in 2008. In November, Metallon Gold, which was a subsidiary of Metallon Corp. of South Africa, placed the Acturus, the How, the Mazowe, the Red Wing, and the Shamva Mines on care-and-maintenance status. New Dawn Mining Corp. of Canada suspended mining at the Turk Mine in October. Also in October, the Golden Valley Mine was closed when electrical power was cut off after the company was unable to pay for electrical power from ZESA Holdings (Pvt) Ltd., which was the Government's electricity company. The company was waiting for the Government to pay for gold delivered to Fidelity Printers & Refineries (Private) Ltd. (Fidelity), which was a subsidiary of the Government's Reserve Bank of Zimbabwe. RioZim Ltd. suspended operations at the Renco gold mine in March because of the lack of payment from Fidelity. Operations were resumed in May after the Government threatened to seize the property (Central African Gold PLC, 2008; Karombo, 2008a, b; Makoshori, 2008a; New Dawn Mining Corp., 2008).

Mineral Trade

In accordance with the Minerals Marketing Corp. of Zimbabwe Act [as modified by the Minerals Marketing Corp. (Exemption) Regulations, 1983 and the Precious Stones Trade Act, 1978], state-owned Minerals Marketing Corp. of Zimbabwe marketed almost all mineral production in Zimbabwe. Gold and silver were required to be sold to Fidelity. PGM concentrates and smelter matte were shipped to processing facilities in South Africa that were operated by Impala Platinum Ltd.

Commodity Review

Metals

Gold.—Fidelity's accreditation with the London Bullion Market Association was suspended in 2008 because the refinery's annual production fell to less than 10 metric tons of gold. The suspension negatively affected the Government's international sales of gold by decreasing the number of available gold buyers for Fidelity's products. Gold mines in Zimbabwe remained adversely affected by the lack of payment for gold delivered to Fidelity, which, by yearend, owed more than $30 million to the mining companies (London Bullion Market Association, The, 2008, p. 3; Mpofu, 2008).

Industrial Minerals

Diamond.—In 2008, the military removed illegal miners who had overrun the Marange diamond deposit in the Chiadzwa area and the military reportedly retained control of the mining operations. African Consolidated Resources plc of the United Kingdom continued its appeal of the 2006 revocation of diamond exploration and mining rights for the Marange license by the Ministry of Mines and Mining Development (African Consolidated Resources plc, 2009; Human Rights Watch, 2009, p. 4).

Outlook

According to the International Monetary Fund (2009), Zimbabwe's rampant inflation began to decline at yearend with the conversion to foreign currency from the Zimbabwe dollar. The real GDP, which has declined by about 40% since 1999, is not expected to recover quickly.

Zimbabwe has abundant mineral resources and a well-developed (but deteriorated) highway and railroad network. The short-term outlook for the mining sector, however, is not favorable. Shortages of electrical power, food, fuel, and skilled employees are expected to continue to affect mineral sector operations adversely in the near term. The chronic lack of foreign exchange, which could abate with the widespread adoption of the use of foreign currency instead of the Zimbabwe dollar, is expected to continue to adversely affect plans for equipment and mine maintenance, mine operations, and proposed mine and plant expansions in the near future. The massive debt load of the state-owned mineral-sector companies casts a significant shadow on their future viability.

The political uncertainty and the future divestment of 51% equity interest in companies under the Indigenization and Economic Empowerment Act are expected to be a negative influence on new investment in the Zimbabwe mining industry; however, optimistic mining companies, especially those from Asia, could pursue mineral-sector investments, especially if the Zimbabwean properties were considered to be inexpensive assets to acquire (Makoshori, 2008b).

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TABLE 1
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007[e]	2008[e]
METALS						
Chromite, gross weight		668,391	614,720	700,001	650,000	650,000
Cobalt, metal content[3]		59	281	26	50	50
Copper:						
Mine output, concentrate, Cu content		2,383	2,570	2,581	3,000	2,000
Metal, refinery output, refined/cathode, primary		7,000 [4]	7,000 [4]	7,000 [4]	6,798 [r, 4]	3,072 [4]
Gold	kilograms	21,330	14,024	11,354	6,750 [4]	3,600
Iron and steel:						
Mine output, iron ore:						
Gross weight	thousand metric tons	283	377	104	110	50
Fe content[e]	do.	140	185	52	55	25
Metal:						
Pig iron	do.	125	129	24 [r]	-- [r]	--
Steel, crude	do.	135	107	24	50 [r]	60
Ferroalloys:						
Ferrochromium		193,077	218,143	200,673	150,000 [r]	150,000
Ferrosilicon chromium		1,000	5,000	2,000 [e]	2,000	2,000
Nickel:						
Mine output, concentrate, Ni content		9,776	8,556	8,825	7,100	6,354 [4]
Refinery output, refined metal:[e]						
Refined from domestic materials		9,700	7,500	5,510 [r]	4,500 [r]	3,400
Toll refined from imported materials[5]		6,000	5,700	9,000	9,500 [r]	10,300
Total refined nickel metal		15,700	13,200	14,500	14,000	13,700

See footnotes at end of table.

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TABLE 1—Continued
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007[e]	2008[e]
METALS—Continued						
Platinum-group metals:						
Palladium	kilograms	3,564	3,879	4,022	4,180 [r, 4]	4,386 [4]
Platinum	do.	4,438	4,834	4,998	5,306 [r, 4]	5,642 [4]
Rhodium	do.	374	404	410	810 [r]	860
Ruthenium	do.	300	317	317	600 [r]	630
Iridium	do.	135	141	147	290 [r]	310
Total	do.	8,811	9,575	9,894	11,200 [r]	11,800
Silver	do.	3,216	187	500 [e]	250	150
Tantalum, mine output, Ta content		14	--	NA	--	--
INDUSTRIAL MINERALS						
Asbestos	thousand metric tons	104	122	97	80	50
Cement, hydraulic[e]	do.	500	600	700	400	400
Clays[6]		700 [e]	600 [e]	300 [e]	600	600
Diamond	carats	44,454	251,152	1,046,000	695,015 [4]	797,198 [4]
Feldspar		1	--	--	--	--
Graphite		10,267	4,298	6,588	5,000	2,000
Kyanite		210	--	--	--	--
Lithium minerals, gross weight		13,710	37,499	30,000 [e]	30,000	25,000
Magnesite		749	893	939	2,000	2,000
Mica[e]		120,000	160,000	130,000	200,000	150,000
Nitrogen, N content of ammonia		47,500	45,000 [e]	10,000 [e]	35,000	25,000
Perlite[e]		4,000	4,000	3,000	3,000	3,000
Phosphate rock, marketable concentrate		83,391	45,705	65,838	30,000	30,000
Stone, sand and gravel:						
Granite, black		8,825	--	1,000 [e]	1,000 [r]	1,000
Limestone	thousand metric tons	41	84	50 [e]	50	50
Silica[7]	do.	70 [e]	20 [e]	12 [e]	--	--
Sulfur:						
Pyrite:						
Gross weight		81,795	59,683	39,777	20,000	18,000
S content (32.6%)		26,670	19,500	13,000	6,500	6,000
Byproduct acid, metallurgical and coal process gas, S content[e]		1,900	1,500	1,000	1,000	1,000
Total[e]		28,600	21,000	14,000	7,500	7,000
Talc		--	--	140	200	200
Vermiculite		27,150	23,045	13,421	10,000	10,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous	thousand metric tons	2,476	2,891	2,107	2,400	2,000
Coke, including metallurgical[e]	do.	180	200	160	400	400

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Table includes data available through February 24, 2010.

[2]In addition to the commodities listed, secondary aluminum; corundum; such gemstones as amethyst, aquamarine, emerald, iolite, and tourmaline; kaolin; secondary lead; and ores of tin and tungsten may be produced, but information is inadequate to estimate output.

[3]Metal includes metal content of compounds and salts and may include cobalt recovered from nickel-copper matte imported for toll refining.

[4]Reported figure.

[5]Toll-refined data include part of the output from the Bindura Refinery and all the production from the Empress Refinery, which processes imported nickel matte from Botswana.

[6]Includes fire clay.

[7]Includes rough and ground quartz and silica sand.

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TABLE 2
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Asbestos	African Associated Mines (Private) Ltd.	Shabanie Mine, Zvishavane	2,400,000
Do.	do.	Gaths Mine, Mashava	1,400,000
Cement:			
Clinker	Portland Holdings Ltd. (Pretoria Portland Cement Ltd.)	Colleen Bawn, about 115 kilometers southeast of Bulawayo	1,000,000
Portland cement	do.	Bulawayo	800,000
Do.	Lafarge Cement Zimbabwe Ltd. (Lafarge, S.A., 76.4%)	Harare	450,000
Do.	Sino-Zimbabwe Cement Company Ltd. (China Building Material Industrial Corporation for Foreign Econo-Technical Cooperation and Zimbabwe Industrual Development Corp.)	Gweru	300,000
Chromite	Zimbabwe Mining and Smelting Co. (Private) Ltd. (Zimasco) [Zimasco Consolidated Enterprises Ltd. (ZCE)]	Peak Mine, Railway Block Mine, and Iron Ton Mine near Shurugwi; Rhodesdale Mine at Lalapanzi	120,000
Do.	Local cooperatives	Mines on the southern Great Dyke	340,000
Do.	do.	Mines on the northern Great Dyke	230,000
Do.	Zimbabwe Alloys Ltd. [Benscore Investments (Private) Ltd.]	Inyala Mine	60,000
Coal	Hwange Colliery Co. Ltd. [Government, 38%; Edwards Nominees (Private) Ltd., 15.46%; Messina Investments Ltd., 12.6%]	3 Main Mine and Chaba Mine, Hwange	5,000,000
Do.	RioZim Ltd.	Sengwa Colliery, about 200 kilometers northeast of Kadoma	5,000,000
Do.	Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Chiredzi, about 130 kilometers southeast of Masvingo	1,200,000
Cobalt:			
Ore, cobalt content	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	800 [1]
Hydroxide	BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	700
Copper:			
Ore, copper content	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	1,600 [1]
Refined	Empress Nickel Refinery (RioZim Ltd.)	Eiffle Flats, near Kadoma	6,000
Diamond carats	Murowa Diamond (Private) Ltd. (Rio Tinto plc, 78%, and RioZim Ltd., 22%)	Murowa Mine, near Zvishavane	252,000
Do. do.	River Ranch Ltd.[2]	River Ranch Mine, near Beitbridge	NA
Do. do.	Zimbabwe Mining Development Corp.[2] (ZMDC)	Marange area	100,000 [e, 3, 4]
Gold kilograms	Mwana Africa PLC	Freda Rebecca Mine, Bindura	2,000 [1]
Do. do.	RioZim Ltd.	Renco Mine, 75 kilometers south-southeast of Masvingo	1,000
Iron and steel:			
Crude steel	Zimbabwe Iron and Steel Co. (Private) Ltd. (Zisco)	Blast furnace at Redcliff, near Gweru	72,000 [1, 5]
Do.	Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Electric-arc furnace at Redcliff	60,000
Ferroalloys, ferrochromium	Zimbabwe Mining and Smelting Co. (Private) Ltd. (Zimasco) [Zimasco Consolidated Enterprises Ltd. (ZCE)]	Smelter at Kwekwe	180,000
Do.	Zimbabwe Alloys Ltd. [Benscore Investments (Private) Ltd.]	Smelter at Gweru	45,000
Rolled steel	Lancashire Steel (Pvt.) Ltd. [Zimbabwe Iron and Steel Co. (Private) Ltd. (Zisco)]	Wire rod mill at Kwekwe	120,000
Do.	Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Rolling mill at Redcliff	100,000
Iron:			
Iron ore, gross weight	Buchwa Iron Mining Co. [Zimbabwe Iron and Steel Co. (Private) Ltd. (Zisco)]	Ripple Creek Mine, near Redcliff	600,000
Sponge iron	Steelmakers Zimbabwe (Private) Ltd. (Steelmakers Ltd.)	Masvingo	54,000

See footnotes at end of table.

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TABLE 2—Continued
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Lithium	Bikita Minerals (Private) Ltd.	Bikita Mine, 60 kilometers east of Masvingo	33,000
Nickel:			
Ore	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	80,000 [1]
Refined metal	BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	15,600 [1]
Do.	Empress Nickel Refinery (RioZim Ltd.)	Eiffle Flats, near Kadoma	9,000
Phosphate	Dorowa Minerals (Private) Ltd. (Chemplex Corp. Ltd., 100%)	Dorowa Mine, 90 kilometers west of Mutare	155,000
Platinum-group metals:			
Ore	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Ngezi Mines	2,200,000
Do.	Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa Mine, east of Zvishavane	1,800,000
Do.	Anglo American Platinum Corp. Ltd.	Unki project	1,440,000 [3]
Concentrate	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous concentrator	2,180,000
Do.	Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa concentrator, east of Zvishavane	1,900,000
Smelter matte	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous smelter	72,000
Pyrite	Iron Duke Pyrites (Chemplex Corp. Ltd.)	Iron Duke Mine	NA
Vermiculite	Shawa Vermiculite (Private) Ltd.	Shawa Mine, near Dorowa	39,000
Do.	Dinidza Vermiculite Mining Co, (Private) Ltd.	Dinidza Mine, near Dorowa	10,000

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Operations suspended.
[2]Ownership disputed.
[3]Under development or redevelopment.
[4]Significantly more diamond was produced from the area in 2006 during the uncontrolled diamond rush.
[5]Nominal capacity 1,000,000 t/yr. Blast furnaces need refurbishment.

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The Mineral Industries of the Middle East

By Mowafa Taib, Philip M. Mobbs, Glenn J. Wallace, David R. Wilburn, and Thomas R. Yager

The 14 nations of the Middle East that are covered in this volume include Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, the United Arab Emirates (UAE), and Yemen. The Middle East region encompasses an area of more than 6 million square kilometers, or about 4% of the world's land mass. According to the World Bank, the total population of the Middle East region in 2008 was estimated to be about 273 million, or 4% of the world's population of 6.7 billion. The region includes 6 of the 12 member states that make up the Organization of the Petroleum Exporting Countries (OPEC), including Iran, Iraq, Kuwait, Qatar, Saudi Arabia, and the UAE, and 7 of the 11 member states that make up the Organization of Arab Petroleum Exporting Countries (OAPEC), including Bahrain, Iraq, Kuwait, Qatar, Saudi Arabia, Syria, and the UAE. The Gulf Cooperation Council (GCC), which is made up of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE, is an important economic and trade organization in the Middle East region (table 1; World Bank, The, 2009).

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For mineral production statistics—

- Bahrain—National Oil and Gas Authority;
- Israel—Mines Department of the Ministry of National Infrastructures;
- Jordan—Department of Statistics and the Natural Resources Authority;
- Kuwait—Central Statistical Office of the Ministry of Planning;
- Qatar—Qatar Statistics Authority and the Ministry of Energy and Industry;
- Saudi Arabia—Central Department of Statistics and Information of the Ministry of Economy and Planning, and Deputy Ministry for Mineral Resources of the Ministry of Petroleum and Mineral Resources;
- Turkey—General Directorate of Mining Affairs of the Ministry of Energy and Natural Resources.

For basic economic and population data—

- The International Monetary Fund and the World Bank Group in the United States.

General Economic Conditions

The economies of Middle Eastern countries continued to grow in 2008 at various rates. The highest economic growth rate in the Middle East region was achieved by Qatar [16.4% of the real gross domestic product (GDP)] whereas Turkey had the lowest rate of economic growth (0.9% of the real GDP) in the region. Economic growth, which was taking place in all the Middle East countries between 2006 and 2008, was driven mainly by exports of hydrocarbons to the world market. For most of 2008, the economies of the oil-producing nations in the region were sustained by the continued high international market prices for crude oil and natural gas. The world's average price of crude oil increased by 36.4% in 2008 compared with that of 2007. The economies of nations that were dependent on imports of refined petroleum products, such as Jordan, however, were adversely affected by the higher international oil prices (table 2; International Monetary Fund, 2009, p. 3).

The availability of low-cost electric energy from the region's abundant supply of natural gas (especially in Iran and the GCC countries) and the region's geographic location (which allows for access to ocean transportation) have provided a solid basis for the region's development of energy-intensive mineral industries. These include aluminum smelting; petrochemical production; fertilizer manufacturing; and the production of such value-added mineral commodities as direct-reduced iron, crude steel, and rolled steel. These industries were considered the backbone of the economic diversification efforts in the region, especially in the GCC countries, which depended on hydrocarbon exports to sustain economic growth.

The construction boom that was taking place in most Middle East countries resulted in higher consumption rates for metals and industrial minerals used as building materials, such as cement and steel reinforcing bars (rebar). In 2008, steel consumption per capita varied widely from one country to another within the Middle East region but was estimated to be between 35 kilograms per year (kg/yr) and 1,240 kg/yr. The GCC countries had the highest estimates of steel consumption, led by the UAE (1,240 kg/yr) and Qatar (461 kg/yr), whereas Iraq (66 kg/yr) and Yemen (35 kg/yr) had the lowest estimates of steel consumption. The per capita steel consumption rates for the remaining countries in the Middle East ranged from 116 kg/yr to 298 kg/yr. According to the Iron and Steel Statistics Bureau, apparent steel consumption in the Middle East region (excluding Turkey) was expected to increase to 60 million metric tons (Mt) and 70 Mt in 2009 and 2010, respectively (Mackrell, 2010, p. 21).

In 2008, the cement industry in the Middle East continued to expand with the construction of new cement plants and the addition of new production lines at existing plants. Cement consumption per capita in the GCC countries was estimated to be, on average, 2,345 kg/yr. The UAE consumed 5,098 kg/yr of cement followed by Qatar (4,710 kg/yr), Oman (1,678 kg/yr), Saudi Arabia (1,625 kg/yr), Kuwait (659 kg/yr), and Bahrain (300 kg/yr). The supply of cement was expected to meet market demand in the GCC countries in 2009; however, in such Middle East countries as Iraq, demand for cement exceeded local supply

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in 2008, and Governments resorted to importing about 6 Mt of cement from neighboring countries, such as Turkey, to meet the increased demand (Middle East Economist Digest, 2009).

Investment Data and Political Risk

State-owned companies dominated the Middle East's mineral industry, although local and foreign investment in the mineral sector were increasing. The construction of new aluminum smelters (as well as production-capacity expansions at existing smelters), new cement plants, new hydrocarbon-processing plants, and new iron-and-steel-processing facilities was underway in several countries. The expansion of the copper mining and refining capacities of state-owned facilities continued in Iran, subject to the availability of Government funds. Progress was made on the development of copper, gold, and phosphate rock resources in Saudi Arabia and the development of zinc resources in Yemen. In 2008, Lafarge S.A. of France increased its presence in the Middle East cement markets by building new cement plants in Iraq and Syria, as well as in Jordan, where it held majority interest in Jordan Lafarge Cement Factories Co. P.S.C. Other regional investors (mainly from Saudi Arabia) and local investors began cement production projects in Jordan, Syria, and Yemen. Al-Rajhi Investment Co. of Saudi Arabia was in the process of building two cement plants in Jordan and one in Syria (International Cement Review, 2009, p. 30).

The U.S. Government renewed sanctions on international and U.S. company investment in Iran under Executive Order 12957 of March 15, 1995; Executive Order 12959 of May 6, 1995; Executive Order 13059 of August 19, 1997; Public Law 104-172 (The Iran Sanctions Act of 1996 [ISA], formerly the Iran-Libya Sanctions Act of 1996 [ILSA]); Public Law 107-24 (ISA Extension Act of 2001, formerly the ILSA Extension Act of 2001); and Public Law 109-293 (Iran Freedom Support Act), which extended the ISA sanctions until 2011. The U.S. Government also renewed Executive Order 13338 of May 14, 2004, and Public Law 108-175 (Syria Accountability and Lebanese Sovereignty Restoration Act), which prohibits trade in most of the items on the commercial control list. The repeal of the antidumping duty, which had been imposed on rebar from Turkey in 1997, went into effect in March.

Legislation

In Iraq, a proposed new hydrocarbon law, which was approved by the Cabinet in February 2007, was still awaiting approval by the Parliament as of December 2008. The Yemen Geological Survey and Mineral Resources Board (GSMRB) of the Ministry of Oil and Minerals of Yemen drafted a new mines and quarries law with the help of the International Finance Corp. (the private sector arm of the World Bank). The new law, which emphasizes transparency, efficiency, and accountability, was expected to be put before the Parliament for approval in 2009. The proposed law would apply an 8% royalty for precious stones, a 5% royalty for nonmetallic minerals, and a 3% royalty for metallic and other minerals. The law also proposes a 30% to 35% corporate income tax on remitted dividends and exempts mining companies from payment of import duties on mining equipment and machinery during mine construction (Yemen Geological Survey and Mineral Resources Board, 2009).

Exploration

State-owned and international oil companies continued exploration for hydrocarbons in almost all the countries in the region. More than five crude oil discoveries were reported in Iran, four in Iraq, three each in Oman and the UAE, and two in Syria. One natural gas discovery was reported in Oman. Exploration activities for natural gas were ongoing in such countries as Kuwait, Saudi Arabia, Syria, and Yemen. Local and international exploration companies were allowed to explore for nonfuel minerals in most of the countries of the region (Organization of Arab Petroleum Exporting Countries, 2009, p. 15-16).

In 2008, metal exploration activity was most notable in Iran, Oman, Turkey, and Yemen. Government agencies engaged in mineral prospecting and general exploration included the Geological Survey of Iran, the Department of Geological Survey of the Directorate General of Minerals in Oman, the Saudi Geological Survey, the General Directorate of Mineral Research and Exploration in Turkey, and the GSMRB of Yemen.

Metal exploration in the region focused on gold (66%) and base metals (34%). Sixteen mining companies were registered with the GSMRB to search for, explore, or exploit base-metals, precious metals, and industrial mineral resources in Yemen. In Iraq, the State Company of Geological Survey and Mining (GEOSURV), which was an agency of the Ministry of Industries and Mining, conducted mapping, mineral exploration, and studies of Iraq's geology (table 3).

In October 2008, the Government of Yemen, Korea National Oil Corp., and Total S.A. of France formed a joint venture to explore for gas and oil in Yemen's onshore Block 70, which is located southeast of the Marib Basin. Two oil discoveries were reported in the Sharnah-1 well of Block 47 and in the basement near the Henin-1 well of Block 71 (Rigzone.com, 2008).

Commodity Overview

The Middle East region was a significant producer of hydrocarbons in 2008. The region accounted for about 31% of the world's total crude oil production and 12.4% of world's natural gas output. The share of the Middle East region in the world mineral production in 2008 also included gypsum, 13%; chromite and potash, 10% each; refinery petroleum products, 9%; phosphate rock, 8%; ammonia, 7%; cement, 6%; primary aluminum, 5%; and crude steel, 3%.

Metals and industrial minerals production made vital contributions to the economies of Iran and Turkey. Metal production also was a notable factor in the economies of Bahrain, Oman, Saudi Arabia, and the UAE. The continued international demand for mineral fuels, especially in the first three quarters of 2008, extended the Middle East region's economic boom (table 4; BP p.l.c., 2009, p. 6, 8, 22, 24).

In tables 5 though 16, estimates for the production of major mineral commodities for 2011 and beyond have been based

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upon supply-side assumptions, such as announced plans for expanded production capacity and new capacity construction, and on bankable feasibility studies of development projects. The outlook tables in this summary chapter show historic production and projected production capacity trends; therefore, no indication is made about whether the data are estimated or reported, and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect current (2008) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes estimates of future production, exploration and mine development, cost of capital projects, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected outcomes. Projects listed in the following section are presented as an indication of industry plans and are not a USGS prediction of what will take place.

Metals

Alumina and Bauxite and Aluminum.—In 2008, about 49,000 metric tons (t) of aluminum was produced at the newly built 360,000-metric-ton-per-year (t/yr)-capacity aluminum smelter at Sohar, Oman. The construction of Qatar's first aluminum smelter, which had 585,000 t/yr of capacity, continued throughout 2008, and full production was scheduled for 2010. Bahrain and the UAE accounted for more than 2% each of the world's aluminum production in 2008 (table 4). Other aluminum producers in the region included Iran and Turkey.

Bahrain and the UAE were among the world's top importers of alumina. According to the United Nations' Comtrade statistics, the UAE was the fifth ranked country in the world in terms of the value of its bauxite ores and alumina concentrates' imports in 2008 and Bahrain was the seventh ranked country.

Aluminum production capacity in the Middle East is expected to increase by more than two-fold from about 2.5 million metric tons per year (Mt/yr) in 2008 to about 5.8 Mt/yr by 2015. The Middle East region's contribution is expected to increase to about 10% of world production from the current 5% following the completion of a $13 billion investment in the region's new smelters. The ongoing construction boom in the Middle East absorbed about 75% of the region's aluminum and aluminum product output. Compared with the production capacity levels of 2008, regional aluminum production capacity was expected to increase by about 88% by 2011; 142% by 2013; and 167% by 2015. The projected increase in aluminum output was attributable to the construction of new smelters (which included South Aluminum Corp. in Iran, Sohar Aluminum Co. in Oman, Qatar Aluminium Ltd. in Qatar, Saudi Arabian Mining Co. (Ma'aden) in Saudi Arabia, and Abu Dhabi Basic Industries Corp. and Emirates Aluminium Co. in the UAE) and the expansion of the Arak and the Al Mahdi smelters in Iran and the Dubai Aluminium Co. Ltd. (Dubal) smelter in the UAE. Additional aluminum smelter capacity was proposed to be built in the planned Jizan Economic City in Saudi Arabia. In addition to primary aluminum production, there were a number of existing downstream facilities in such countries as Bahrain, Oman, Qatar, and the UAE that produced value-added aluminum products (table 6; Bains, 2010, p. 30).

Regional bauxite production capacity was projected to increase significantly by 2014 (compared with that in 2008) following the expected commissioning of the Az Zabirah bauxite mine for Ma'aden. Bauxite from Az Zabirah was to be processed at Ma'aden's planned alumina refinery and aluminum smelter complex at Ras al-Zour, which would be operated as a joint venture of Alcoa Inc. of the United States and Ma'aden.

The future of the aluminum industry in the Middle East region is likely to be determined by two principal factors. The first factor is the availability of sufficient quantities of natural gas to generate electricity for the smelters, and the second factor is the acquisition of a sufficient supply of alumina (Sell, 2010).

Copper.—The Middle East region was a minor contributor to the world's copper supply. Iran was the most notable copper producer in the region and the leading Middle Eastern country in terms of the size of its copper deposits, which were estimated by the National Iranian Copper Industries Co. (NICICO) to be 1.9 billion metric tons (Gt) of ore containing 14 Mt of copper, or about 3% of the world's reserves. Iran's production of 240,000 t of copper in 2008 represented only 1.5% of the world's production, and the country was pursuing plans to increase its production capacity to 440,000 t/yr by 2013. In 2008, NICICO moved forward with the construction of the Chehel-Kooreh Mine, the Yazd Ali-Abad Mine, and the Zahedan Mine. NICICO also was building new copper concentrators at the Sarcheshmeh Mine and the Sungan Mine (tables 7, 8; Gavin, 2010; Middle East Economic Digest, 2010, p. 29).

In Saudi Arabia, Ma'aden's Al Amar Mine started copper production at a rate of 1,100 t/yr in 2008. Two other copper projects were under development and expected to begin production in 2011. The first was the Al-Masane mining project, which was being developed by the Al Masane Al Kobra Mining Co. (a private company owned by Saudi and U.S. investors) and which was expected to produce 16,300 t/yr of copper concentrate in 2011 and 35,200 t/yr by 2013. The second was the Jabal Sayid project, which was owned by Bariq Mining Ltd. (a joint venture of Citadel Resource Group Ltd. of Australia and Consolidated Mining Co.) and which was expected to produce 57,000 t/yr of copper concentrate (Gavin, 2010; Middle East Economic Digest, 2010, p. 29).

Oman produced a relatively small amount of copper but copper emerged as a significant contributor to the country's exports. Oman's copper exports in 2008 were valued at about $66 million, which was an increase of 6% compared with those of 2007. National Mining Co. L.L.C. (NMC) continued to produce copper, gold, and silver at the Hatta and the Shinas pits in the Al Batinah region. The company was exploring for copper, gold, and silver at its Ajib pit, which is located near the Shinas pit along the border with the UAE (National Mining Co. L.L.C., 2009; Gavin, 2010, p. 30).

In Yemen, Cantex Mine Development Corp. of Canada began drill tests of the Suwar cobalt, copper, and nickel deposit following the completion of an 11-hole drilling program at

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the Wadi Qutabah project. Cantex planned to complete a prefeasibility study of the Suwar project by mid-2012. In November, Companhia Vale Do Rio Doce (CVRD) of Brazil committed a $2 million option to the project, drilled near the mineralization area discovered by Cantex, collected and analyzed soil samples, and performed geophysical surveys. Cantex and CVRD were trying to discover a continuous mineralization that would make the prefeasibility study worth additional investment .

In October, Altos Hornos de México S.A. de C.V. (AHMSA) suspended the Timna Copper Mine project in Israel. The project had been expected to produce and export 22,000 t/yr of refined copper by 2010. The cost of the project was estimated to be more than $200 million. The reason for the decision by AHMSA was the Government's refusal to grant $35 million that had been promised to AHMSA's subsidiary Arava Mines Ltd. according to the Law for the Encouragement of Capital Investment (Coren, 2009).

Gold.—The Middle East was a significant gold trading region, and the region's jewelry manufacturing sector was a noted consumer of gold. Until the end of 2008, the UAE gold refineries produced gold that was used entirely by the jewelry market. After 2008, refined gold was often used as an investment product, such as in exchange trade funds and gold futures (Shekhar, 2010).

The Middle East's gold mines were modest contributors to the world's supply of precious metals. Plans to increase mine output of gold significantly in Iran, Saudi Arabia, and Turkey could result in the region's gold production reaching an annual volume of about 29 t by 2011 (table 9).

The value of gold trade at the Dubai Multi Commodities Center (DMCC) increased to $29 billion in 2008, which was an increase of 53% compared with a value of $19 billion in 2007. The volume of gold exports in 2008 increased to 371 t from 287 t in 2007, or by 29%. The volume of gold imports in 2008 increased to 674 t from 559 t in 2007, which was an increase of 21% (Dubai Multi Commodities Center, 2009).

Iron Ore and Iron and Steel.—*Iron Ore.*—Iron ore was produced from several mines in Iran and from the Divrigi Mine in Turkey. Several iron ore deposits in Saudi Arabia had been explored in the past and some of the deposits of the Wadi Sawawin formation in northwestern Saudi Arabia were reevaluated in 2007. Significant increases in production capacity were planned for Iranian iron ore mines, including expansions of the mines of Chadormalu Mining and Industrial Co., Gol-e-Gohar Iron Ore Co., and Sangan Iron Ore Co.; ongoing development of the Jalal Abad Mine; and the opening of Iran Central Iron Ore Co.'s new facilities at Bafgh, at the Bafgh North Anomaly, and at Chahgaz and Mishdovan. In Turkey, which produced about 4 Mt of iron ore in 2008, Hekimhan Madencilik İthalat İhracat San. ve Tic. A.Ş. (a subsidiary of Kolin İnşaat Turizm San. ve Tic. A.Ş.) moved forward with building a calcination plant to produce about 1 Mt/yr of calcined siderite sintering dust from 2 Mt/yr of ore by 2011 (table 10; Hekimhan Madencilik İthalat İhracat San. ve Tic. A.Ş., 2008).

Steel.—Steel demand in the region was driven mainly by the demand for rebar by the construction industry for residential and commercial housing projects. In the past few years, the highest demand has been from Iran, Saudi Arabia, Turkey, and the UAE. In Iran, the Government's Fourth Five-Year Development Program included expanding the capacity of the steel plants at Bafgh in Yazd Province, Miyaneh in East Azarbaijan Province, Neiriz in Fars Province, Qaenat (Ghaenat) in South Khorasan Province, Sefid Dasht in Chahar Mahal va Bakhtiari Province, Shadegan in Khuzestan Province, and Sirjan in Kerman Province. Additional crude steel plants were planned to be built at Bandar Abbas and Hamadan, and production capacity expansions were scheduled to be completed at the steel plants of Isfahan Steel Co., Khuzestan Steel Co., and Mobarekeh Steel Co.

Other new crude steel facilities in the region that were expected to begin producing crude steel between 2009 and 2011 included the Shadeed Iron & Steel LLC plant in Oman; the Al Atoun Steel Industries Co. plant at Yanbu, Saudi Arabia; the Rajhi Steel Industries plant at Jeddah, Saudi Arabia; the Hmisho International Steel S.A. plant at Adra, Syria; the Emirates Steel Industries plant at Musafah, the UAE; the Essar Group's plant at the Hamriya Free Zone, the UAE; and the United Steel Holding Co. (Foulath) plant at Al Hidd, Bahrain. Planned crude steel production-capacity-expansion projects included the rampup of the fourth electric arc furnace (EAF), which was installed in 2008 at the Qatar Steel Co. plant in Qatar, and the commissioning of a fifth EAF at Qatar Steel by 2009.

Crude steel production in the Middle East region exceeded 44 Mt in 2008. Turkey, which produced 26.8 Mt of steel in 2008, or more than 60% of the total Middle East steel production, was the tenth ranked world steel producer. Iran, which was the second ranked steel producer in the Middle East region, accounted for 23% of total production in the region followed by Saudi Arabia, which accounted for 11%. Turkey was the region's leading steel exporter and was responsible for 67% of the UAE's steel imports and 8% of the world's steel imports (table 11).

Lead and Zinc.—Iran, Saudi Arabia, and Turkey were the only countries in the Middle East that produced lead and zinc in 2008. Projects of the Government of Iran's Fourth Five-Year Development Program accounted for most of the planned expansion of lead and zinc ore and zinc metal production capacities in the region. Included in the 5-year plan were the expansion of production from the Anguran lead and zinc mine and the anticipated construction of a 100,000-t/yr-capacity zinc plant in the Zanjan district (tables 13, 14; Iranian Mines and Mining Industries Development and Renovation Organization, 2005, p. 195).

Zinc production at the Al Amar Mine of Ma'aden began in January 2008 at an expected capacity of 200,000 t/yr of ore. Commencement of the Al-Massane Mine of the Al-Massane Al–Kobra Mining Co. of Saudi Arabia and the United States was scheduled in 2009. The mine was expected to produce 58,000 t/yr of zinc concentrate.

Jabal Salab Company Ltd., which was registered in the Cayman Islands, and owned jointly by ZincOx Resources p.l.c. of the United Kingdom (52% interest) and Ansan Wikfs Investments Ltd. of Yemen (48%), continued with construction of the Jabali lead, silver, and zinc mine, which was the first large-scale metal mine in Yemen. Production was expected to begin in the first quarter of 2010. The operation would mine 800,000 t/yr of zinc ore to produce 70,000 t/yr of zinc oxide.

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The open pit was expected to be operational for more than 12 years. The deposit was estimated to contain 12.6 Mt of oxide ore grading 1.2% lead, 68 grams per metric ton (g/t) silver, and 8.9% zinc, and minable reserves were estimated to be 8.7 Mt grading 9.2% zinc with a zinc cutoff grade of 4.4% (Yemen Geological Survey and Mineral Resources Board, 2009; ZincOx Resources plc, 2009, p. 10).

Nickel.—No nickel was produced in the Middle East region in 2008. The dramatic decline in nickel prices during the last three quarters of 2008 resulted in the significant slump in nickel exploration activity in Turkey, which was the only country in the region that had notable nickel reserves. European Nickel plc of the United Kingdom was awaiting the issuance of a forestry permit before proceeding with engineering work for the Çaldag Mine, which is located in western Turkey and which was expected to produce 24,500 t/yr of nickel. Aldridge Minerals suspended work on its Murat Dag nickel laterite project and the joint venture of Lydian International Ltd. and Newmont Overseas Exploration Ltd. decided to seek a partner to develop its Muratdag gold-nickel prospect (table 12; Aldridge Minerals Inc., 2009, p. 3; European Nickel plc, 2009; London Metal Exchange Ltd., undated).

Mineral Fuels and Related Materials

Coal.—Iran and Turkey were the only countries in the Middle East region that produced coal. Iran planned to double its output capacity of coal to more than 4 Mt/yr by yearend 2011. Production of coke from coal was begun at the Zarand Iranian Steel Co.'s 400,000-t/yr-capacity plant, which was located at Zarand, Kerman Province, and reached 60% of capacity by yearend 2008. In Turkey, coal production was used primarily for electrical power generation. Although the Turkish Government encouraged the use of natural gas for new power generation projects and retained control of hydroelectric generating facilities, many of Turkey's lignite and subbituminous coal operations had been divested to the private sector in the past decade. Coal production was expected to vary, depending on the demand for electric power not met by imported natural gas (table 15).

The Government of Oman was evaluating a project to build a coal-fired powerplant at Duqm in the Wusta region to reduce its dependence on natural gas. The independent powerplant would have 1,000 megawatts (MW) of capacity and was expected to commence production in 2012. The plant would use coal imported from the international market and from local coal deposits.

In July, the Government of the Emirate of Ajman in the UAE signed an agreement with MMC Corp. Bhd of Malaysia to establish the first coal-fired powerplant in the Gulf region. The $2 billion plant was expected to have the capacity to generate 1 gigawatthour of electricity and to commence production in 2012. In December, Ras Al-Khaimah Investment Authority was preparing to invite bids for a coal-fired powerplant to be built at Mina Saqr, which is located 110 kilometers (km) northeast of Dubai, UAE. The initial capacity of the plant would be 500 to 600 MW; this amount could increase to 4,000 MW in the final phase of the project (Carlisle, 2008; Maree, 2008).

Natural Gas.—The Middle East region's natural gas reserves were estimated to be about 76 trillion cubic meters, or 41% of the world's total reserves. Iran and Qatar were the second and third ranked countries in the world in terms of the size of their natural gas reserves, which were estimated to be 29.61 trillion cubic meters (16% of the world's natural gas reserves) and 25.46 trillion cubic meters (13.8% of the world's natural gas reserves), respectively. Production of natural gas in the region was 381.4 billion cubic meters in 2008, which was an increase of 6.3% compared with that of 2007. Iran was the region's leading producer of natural gas followed by Saudi Arabia, then Qatar. Although natural gas was produced by all the countries of the Middle East in 2008, only four countries were net natural gas exporters. The region's natural gas exports totaled 79.5 billion cubic meters in 2008; 71.4% of the gas was exported by Qatar, which was the world's leading exporter of natural gas; 13.7%, by Oman; 9.6%, by the UAE; and 5.3%, by Iran (BP p.l.c., 2009, p. 22, 24; Organization of Arab Petroleum Exporting Countries, 2009, p. 59).

Qatar's gas-to-liquids (GTL) projects, which aim to make natural gas a portable global commodity, continued to receive the Government's support. In November 2008, Oryx GTL, which was a joint venture between Qatar Petroleum and Sasol Ltd. of South Africa, was established to convert natural gas to diesel, naphtha, and liquefied petroleum gas. Oryx GTL announced that it would achieve the 34,000-barrel-per-day (bbl/d) production target within 1 year (Petroleum Economist, 2008).

In Yemen, the construction of a two-train 6.7-Mt/yr capacity natural gas liquefaction plant and related dock facilities at the Balhaf terminal on the Gulf of Aden for Yemen LNG Co. continued in 2008. The $4.5 billion that was invested mainly by Total (39.62%), Hunt Oil Co. of the United States (17.22%), and Yemen Gas Co. (16.73%) in the Yemen Liquefied Natural Gas (LNG) project was considered the single largest investment ever made in the country. The first shipment of LNG was expected by yearend 2009 using four LNG carriers that were being built in Japan with a total capacity of 644,000 cubic meters (Yemen LNG Co., 2009, p. 3, 8, 29).

Petroleum.—The Middle East region's proved crude oil reserves were estimated to be more than 754 billion barrels, or about 60% of the world's total crude oil reserves. The region's crude oil production increased by 4% in 2008 compared with that of 2007. Saudi Arabia was the leading petroleum producing country in the world and the region; the other leading regional producers were, in order of volume produced, Iran, the UAE, and Kuwait. Crude oil production increased by 13% each in Iraq and Qatar in 2008 compared with that of 2007 and Yemen's crude oil production decreased by 11.6%. The Middle East region's crude oil exports averaged 18.1 million barrels per day in 2008, 70% of which came from the GCC countries (BP p.l.c., 2009, p. 8; International Monetary Fund, 2009, p. 39).

DNO International ASA of Norway made four new oil discoveries in 2008 and completed the first phase of the Tawke production-sharing contract (PSC) with the KRG in northern Iraq. A consortium led by Korea National Oil Corp. (KNOC) (Government of the Republic of Korea, 100%) signed a $2.1 billion PSC with the KRG in November 2007

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for the development of the Hawler, the Qush Tapa, the Sangaw South fields, and the Bazian Block in the Kurdistan region of Iraq. Following the withdrawal of some consortium partners, KNOC decided to continue solo in the project and signed a contract with KRG that gave KNOC access to eight oilfields in northern Iraq. In August 2008, North Oil Co., which was one of the Government-owned oil companies, signed a $3 billion agreement with China National Petroleum Corp. (CNPC) for the development of the Al-Ahdab oilfield, which was expected to increase production to 115,000 bbl/d from 90,000 bbl/d after 7 years of the 20-year contract (Petroleum Economist, 2008, p. 36).

In May, Jordan's Natural Resources Authority signed a concession agreement with Jordan Oil Shale Co. B.V. (a subsidiary of Royal Dutch Shell plc of the Netherlands) to explore for oil resources in oil shales in Jordan, which had been estimated to be more than 40,000 Mt (Oil & Gas Journal, 2008).

In December, CNPC and International Petroleum Investment Co. (IPIC) signed an engineering, procurement, and construction contract for the Abu Dhabi Crude Oil Pipeline (ADCOP). ADCOP was to be a 400-km pipeline that would carry oil from the Habshan oilfield to the Port of Fujairah on the Gulf of Oman. The $3.29 billion project would be jointly executed by China Petroleum Engineering & Construction Corp. and China Petroleum Pipeline Bureau. It was the largest overseas turnkey engineering construction project for which CNPC had ever contracted. The project was expected to be completed by August 2011. ADCOP would enable the UAE to export up to 60% of its oil production from Gulf of Oman, thus bypassing the checkpoints at the Strait of Hormuz and the potential navigation risk in the Gulf of Oman waters (Pipeline & Gas Journal, 2009; U.S. Energy Information Administration, 2009).

Uranium.—In Turkey, Aldridge Minerals Inc. of Canada acquired mineral licenses for properties that had the potential for uranium mineralization. At yearend 2008, ownership of the uranium properties was transferred to Aldridge Uranium Inc., which was a newly formed company owned by Aldridge Minerals shareholders. No information was available on uranium production in Iran in 2008 (table 16).

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TABLE 1

MIDDLE EAST: 2008 TOTAL AREA AND POPULATION

Country	Total area[1] (square kilometers)	Estimated population[2] (millions)
Bahrain	665	0.8
Iran	1,648,000	72.0
Iraq	437,072	28.9 [3]
Israel	20,770	7.3
Jordan	92,300	5.9
Kuwait	17,820	2.7
Lebanon	10,400	4.1
Oman	212,460	2.8
Qatar	11,437	1.3
Saudi Arabia	2,149,690	24.6
Syria	185,180	21.2
Turkey	780,580	73.9
United Arab Emirates	83,600	4.5
Yemen	527,970	23.1
Total	6,177,944	273.1
World	148,940,000 [4]	6,692.0

[1]Source: U.S. Central Intelligence Agency, The World Factbook 2009.

[2]Source: The World Bank, 2008 World Development Indicators Database.

[3]Source: U.S. Central Intelligence Agency, The World Factbook 2009.

[4] Land area.

TABLE 2

MIDDLE EAST: GROSS DOMESTIC PRODUCT[1, 2]

Country	Gross domestic product based on purchasing power parity: Gross value (million dollars)	Gross domestic product based on purchasing power parity: Per capita (dollars)	Real gross domestic product growth rate (percentage): 2006	2007	2008
Bahrain	27,014	34,662	6.7	8.1	6.1
Iran	805,365	11,052	5.8	7.8	2.5
Iraq	105,737	3,477	6.2	1.5	9.5
Israel	202,562	28,474	5.3	5.2	4.0
Jordan	32,416	5,537	8.0	8.9	7.9
Kuwait	137,415	39,915	5.1	2.5	6.3
Lebanon	49,525	13,006	0.6	7.5	8.5
Oman	68,331	24,674	6.0	7.7	7.8
Qatar	94,404	86,008	15.0	15.3	16.4
Saudi Arabia	592,886	23,814	3.2	3.3	4.4
Syria	94,563	4,757	5.1	4.2	5.2
Turkey	915,212	13,139	6.9	4.7	0.9
United Arab Emirates	185,287	38,894	9.4	6.3	7.4
Yemen	55,393	2,411	3.2	3.3	3.6
Total	3,366,110	XX	XX	XX	XX
World total	69,489,850	XX	5.1	5.2	3.0

XX Not applicable.

[1]Source: International Monetary Fund, World Economic Outlook Database, October 2009.

[2]Gross domestic product listed may differ from that reported in individual country chapters owing to differences in source or date of reporting.

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TABLE 3

SELECTED MIDDLE EAST EXPLORATION ACTIVITY IN 2008

Country	Type[1]	Prospect	Commodity[2]	Companies	Resource notes[2, 3]	Exploration notes
Iran	P	Sarcheshmeh	Cu, Mo, Au, Ag	National Iranian Copper Industries	8.4 Mt Cu, 360,000 t Mo, 10.4 Moz Au, 150 Moz Ag	Ongoing exploration associated with mine expansion.
Turkey	E	Agi Dagi	Au, Ag	Fronteer Development Group Inc.	800,000 oz Au, 6.7 Moz Ag	Completed $10 million exploration drilling program.
Do.	E	Altintepe	Au	Stratex International plc.	320,000 oz Au	Ongoing resource definition drilling program.
Do.	D	Caldag	Ni, Co	European Nickel plc.	375,000 t Ni, 23,000 t Co	Ongoing permitting.
Do.	P	Cayeli	Cu, Zn, Au, Ag	Inmet Mining Corp.	334,000 t Cu, 509,000 t Zn, 190,000 oz Au, 14 Moz Ag	Ongoing mine infrastructure improvement program.
Do.	D	Cöpler	Au, Ag, Cu	Anatolia Minerals Development. Ltd.	3.7 Moz Au, 11 Moz Ag, 95,000 t Cu	Ongoing drilling. Commenced construction.
Do.	E	Corak	Au, Cu	Mediterranean Resources Ltd.	540,000 oz Au, 650,000 oz Ag, 29,000 t Pb, 48,000 t Zn	Ongoing drilling.
Do.	F	Efemçukuru	Au	Eldorado Gold Corp.	1.5 Moz Au	Completed program of mapping, sampling, and drilling.
Do.	E	Halilaga	Au, Cu	Teck Cominco Ltd.	Data not released	Completed drilling program.
Do.	E	Karakartal	Cu, Au	Anatolia Minerals Development Ltd.	do.	do.
Do.	E	Kiziltepe	Au, Ag	Ariana Resources plc.	100,000 oz Au, 1.8 Moz Ag	Ongoing drilling.
Do.	E	Tac	Au, Cu	Mediterranean Resources Ltd.	1 Moz Au, 27,000 t Cu	do.
Do.	E	Tavsan	Au, Ag	Ariana Resources plc.	87,000 oz Au, 230,000 oz Ag	Ongoing exploration. Scoping study planned.
Do.	E	Yenipazar	Zn	Aldridge Minerals Inc.	880,000 oz Au, 26 Moz Ag, 80,000 t Cu, 280,000 t Pb, 370,000 t Zn	Completed bulk sampling and drilling programs.
Yemen	F	Jabali	Zn	ZincOx Resources plc.	800,000 t Zn	Ongoing exploration. Development planned.

Do., do. Ditto.

[1]D—Development approved or ongoing; E—Active exploration; F—Feasibility work ongoing/completed; P—Exploration at producing site.

[2]Abbreviations used for commodities in this table are as follows: Ag, silver; Au, gold; Co, Cobalt; Cu, copper; Mo, molybdenom; Ni, nickel; Pb, lead; Zn, zinc. Abbreviations used for units of measure in this table are as follows: Moz, million troy ounces; Mt, million metric tons; oz, troy ounces; t, metric tons.

[3]Resources reported where available based on data from various public sources at the measured + indicated level unless otherwise specified. Data were not verified by the U.S. Geological Survey.

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TABLE 4

MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2008[1]

(Thousand metric tons unless otherwise specified)

	Metals			Industrial minerals					Mineral fuels and related materials	
									Petroleum	
Country	Aluminum, metal, primary	Chromite, mine output, gross weight	Steel, crude	Ammonia, N content	Cement, hydraulic	Gypsum	Phosphate rock, gross weight	Potash, K_2O equivalent	Crude, including condensate (thousand 42-gallon barrels)	Refinery products (thousand 42-gallon barrels)
Bahrain	872	--	--	474	370	--	--	--	66,864	96,368
Iran[e]	248	180	9,960	2,000	44,400	12,000	325	--	1,490,000	600,000
Iraq	--	--	--	10 [e]	6,455	2	--	--	884,395	163,155
Israel[e]	--	--	480	--	5,000	83	3,088 [2]	2,300	8	90,800
Jordan	--	--	150 [e]	--	4,284	232	6,266	1,223	16	28,600 [e]
Kuwait[e]	--	--	500	485	2,200	--	--	--	990,000	329,000
Lebanon[e]	--	--	--	--	4,200	30	--	--	--	--
Oman	49	784	84 [e]	1,000 [e]	4,000	180	--	--	276,971	37,187
Qatar	--	--	1,434	1,797	3,500 [e]	135	--	--	305,500	96,433
Saudi Arabia	--	--	4,670	2,600 [e]	31,823	2,300	--	--	3,359,000	721,370
Syria	--	--	63	120 [e]	5,336	573	3,221	--	139,081	90,621
Turkey	65	1,886	26,809	--	51,432	3,000 [e]	--	--	14,700 [e]	172,000 [e]
United Arab Emirates	920	34	100 [e]	380 [e]	13,200	160 [e]	--	--	951,660	148,000 [e]
Yemen	--	--	--	--	2,111	50	--	--	107,400	37,248
Total	2,150	2,880	44,300	8,870	178,000	18,700	12,900	3,520	8,590,000	2,610,000
Share of world total	5%	10%	3%	7%	6%	13%	8%	10%	31%	9%
United States	2,660	--	91,900	7,850 [3]	87,600	17,900	30,200	1,100	1,940,000	6,620,000
World total	39,600	28,000	1,330,000	128,000	2,840,000	142,000	165,000	34,900	27,700,000	30,200,000

[e]Estimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. -- Zero.

[1]Totals may not add due to independent rounding. Percentages are calculated on unrounded data. Table includes data available as of June 21, 2010.

[2]Reported figure.

[3]Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.

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TABLE 5

MIDDLE EAST: HISTORIC AND PROJECTED BAUXITE MINE PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	148,000	485,130	437,595	520,000	710,000	710,000	710,000
Saudi Arabia	--	--	--	--	--	--	3,500,000
Turkey	232,278	458,537	475,349	350,000	800,000	800,000	800,000
Total	380,000	944,000	913,000	870,000	1,500,000	1,500,000	5,000,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 6

MIDDLE EAST: HISTORIC AND PROJECTED PRIMARY AND SECONDARY ALUMINUM PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Bahrain[2]	450,709	509,308	750,710	876,580	870,000	870,000	870,000
Iran	119,400	140,000	220,000	248,000	470,000	745,000	745,000
Oman	--	--	--	49,000	360,000	360,000	360,000
Qatar	--	--	--	--	585,000	585,000	585,000
Saudi Arabia	--	--	--	--	--	200,000	740,000
Turkey	61,514	61,000	60,000	65,000	65,000	65,000	65,000
United Arab Emirates	247,400	470,000	722,000	920,000	1,700,000	2,400,000	2,400,000
Total	879,000	1,180,000	173,000	2,160,000	4,100,000	5,200,000	5,800,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

[2]May include some secondary aluminum produced from used beverage cans.

TABLE 7

MIDDLE EAST: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1995-2015[1, 2]

(Metal content of concentrate in thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	102	125	190	240	350	350	350
Oman	--	--	--	1	1	1	1
Saudi Arabia	1	1	1	1	10	16	10
Turkey	24	70	54	83	80	80	80
Total	127	196	245	325	440	450	440

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

[2]Copper content of mined ore (gross weight).

TABLE 8

MIDDLE EAST: HISTORIC AND PROJECTED REFINED COPPER METAL PRODUCTION, 1995-2015[1, 2]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	90,400	155,856	178,000	200,000	300,000	440,000	440,000
Oman	33,900	24,281	24,543	12,000	22,000	22,000	22,000
Turkey	100,300	64,100	95,000	90,000	100,000	100,000	100,000
Total	225,000	244,000	298,000	302,000	420,000	560,000	560,000

[e]Estimated.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

[2]May include secondary production.

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TABLE 9

MIDDLE EAST: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1995-2015[1]

(Metal content of ore in kilograms)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	630	216	1,000	400	500	500	500
Oman	591	551	384	43	--	--	--
Saudi Arabia	8,080	3,800	7,456	4,527	8,000	8,000	8,000
Turkey	1,200	500	4,170	11,120	17,000	15,000	15,000
Total	10,500	5,100	13,000	16,100	26,000	24,000	24,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 10

MIDDLE EAST: HISTORIC AND PROJECTED BENEFICIATED IRON ORE PRODUCTION, 1995-2015[1]

(Metal content of ore in thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	4,500	5,800	9,162	12,000	30,000	30,000	30,000
Turkey	2,750	2,200	2,450	2,100	2,700	2,700	2,700
Total	7,000	8,000	12,000	14,000	33,000	33,000	33,000

[e]Estimated.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 11

MIDDLE EAST: HISTORIC AND PROJECTED CRUDE STEEL PRODUCTION, 1995-2015[1]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	4,696	6,600	9,400	9,960	15,000	29,000	29,000
Iraq	300	50	--	--	--	1,500	2,000
Israel	200	280	480	480	480	480	480
Jordan	30	30	150	150	390	390	390
Kuwait	--	--	450	500	500	500	500
Oman	--	--	84	84	1,200	1,200	1,200
Qatar	614	744	1,057	1,434	1,500	1,500	1,500
Saudi Arabia	2,451	2,973	4,185	4,670	6,500	6,500	6,500
Syria	70	70	70	70	590	590	590
Turkey	12,744	14,325	20,960	26,809	27,000	27,000	27,000
United Arab Emirates	--	90	90	90	1,700	3,400	6,500
Total	21,000	25,000	36,000	44,000	59,000	72,000	76,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 12

MIDDLE EAST: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1995-2015

(Metal content of ore in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Turkey	--	--	1,000	--	--	20,000	20,000

[e]Estimated; estimated data are rounded to no more than three significant digits. -- Negligible or no production.

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TABLE 13
MIDDLE EAST: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1995-2015[1]

(Metal content of ore in metric tons)

Country[2]	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	145,100	90,000	167,000	150,000	180,000	180,000	180,000
Saudi Arabia	500	3,000	--	3,663	3,000	3,000	3,000
Turkey	9,118	39,000	36,000	80,000	50,000	50,000	50,000
Total	155,000	132,000	203,000	233,000	230,000	230,000	23,000

[e]Estimated. -- Negligible or no production.
[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
[2]In Yemen, the Jabail zinc deposit was to be developed as a zinc oxide project. Output of 70,000 metric tons per year of zinc oxide was expected to start in 2010. The ore would be treated hydrometallurgically and not concentrated.

TABLE 14
MIDDLE EAST: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1995-2015[1]

(Metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	--	51,475	120,000	100,000	230,000	230,000	230,000
Turkey	17,050	--	--	--	--	--	--
Total	17,100	51,500	120,000	100,000	230,000	230,000	230,000

[e]Estimated. -- Negligible or no production.
[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 15
MIDDLE EAST: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1995-2015[1, 2]

(Thousand metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran	1,640	2,002	1,898	2,000	4,500	4,500	4,500
Turkey	59,408	64,645	58,676	89,296	90,000	80,000	80,000
Total	61,000	67,000	61,000	91,000	94,000	84,000	84,000

[e]Estimated.
[1]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes anthracite, bituminous, and lignite.

TABLE 16
MIDDLE EAST: HISTORIC AND PROJECTED URANIUM PRODUCTION, 1995-2015

(Metal content in metric tons)

Country	1995	2000	2005	2008	2011[e]	2013[e]	2015[e]
Iran[1]	--	--	NA	NA	50	50	50

[e]Estimated; are rounded to no more than three significant digits. NA Not available. -- Negligible or no production.
[1]Uranium may have been produced in 2005 and 2008, but information is inadequte to estimate output.

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The Mineral Industry of Bahrain

By Mowafa Taib

The Kingdom of Bahrain is one of the six nations that make up the Gulf Cooperation Council[1] (GCC); it is an island located between Qatar and Saudi Arabia and is connected to the eastern region of Saudi Arabia by way of a 28-kilometer-long bridge called the King Fahad Causeway. In 2008, Bahrain was the world's 10th ranked producer of aluminum and accounted for 2.2% of world aluminum output. Primary aluminum was sold to downstream aluminum manufacturers in Bahrain and exported to more than 25 countries. Other minerals and mineral-based commodities produced in Bahrain included aggregate, cement, crude petroleum, iron ore pellets, natural gas, nitrogen fertilizer, refined petroleum products, sand, and sulfur (Aluminium Bahrain B.S.C., 2009; Bray, 2009, p. 19).

Minerals in the National Economy

Bahrain's economy grew in 2008 at a rate of 6.3% (at 2000 prices) compared with 8.4% in 2007 despite the fall in oil prices that started in the fourth quarter of 2008. The mining sector, which included the production of natural gas and oil, as well as quarrying activity, accounted for 14% of the gross domestic product (GDP); the manufacturing sector, which included aluminum production, accounted for 16% of the GDP; and the construction sector accounted for 7.3% of the GDP. In 2008, gas and oil revenue increased by 39.9% and non-oil revenue decreased by 0.9% compared with oil and non-oil revenue in 2007, respectively. The value of petroleum products exports, which was 80% of total exports, increased by 27.7% in 2008 compared with that of 2007; and the value of oil imports, which was 50% of total imports, increased by 22.8% in 2008 compared with that of 2007 (Central Bank of Bahrain, 2009b, p. 5; Ministry of Finance, 2009a, b).

The provisional value of Bahrain's total merchandise exports was $17.3 billion,[2] of which $13.8 billion was petroleum products and $3.5 billion was non-oil merchandise exports. Non-oil exports included base metals, which were mainly aluminum and steel products. The provisional value of Bahrain's total imports was $14.2 billion, of which $7.2 billion was oil-related imports and $7.0 billion was non-oil-related imports (Central Bank of Bahrain, 2009a, p. 7, 10).

Structure of the Mineral Industry

The National Oil and Gas Authority (NOGA) was the Government agency that managed Bahrain's hydrocarbon resources. NOGA was the sole owner of Bahrain Petroleum Co., B.S.C. (Closed) (Bapco), and it held 60% interest in Bahrain Aviation Fueling Co.; 75% interest in Bahrain National Gas Co., B.S.C.; 33% interest in Gulf Petrochemical Industries Co. B.S.C. (GPIC); and smaller interests in several companies in the petrochemical sector. Bahrain Mumtalakat Holding Co. (Mumtalakat) (the investment entity of the Government) held 77% interest in Aluminium Bahrain B.S.C. (Alba), which was the Kingdom's oldest non-oil industry; the remaining shares were held by Sabic Industrial Investments Co. Ltd. of Saudi Arabia (20%) and Breton Investments Ltd. of Germany (3%). The proposal to divest up to 40% of Alba through an initial public offering, which was announced in 2007, had not materialized as of yearend 2008 (National Oil and Gas Authority, 2008; Middle East Economic Digest, 2009a). Private and mixed public-private sector companies controlled the cement and pelleted iron ore industries.

In 2008, Gulf United Steel Holding Co. (Foulath) was established in Bahrain as a holding company for investments in the steel industry. It was a joint venture of Gulf Investment Corp., which was owned jointly by the GCC countries (50%); Qatar Steel Co., which was owned by the Government of Qatar (25%); Kharafi Group of Kuwait and National Industries Group of Kuwait (10% each); and Kuwait Foundry Co. (5%) [Middle East Economic Digest, 2008b; Gulf Industrial Investment Co. (E.C.), 2009].

Production

Crude petroleum production from the Bahrain field (also known as the Awali field) continued its downward production trend. In 2008, 12.0 million barrels (Mbbl) of crude petroleum was produced compared with 12.6 Mbbl of crude petroleum in 2007, which was a reduction of 4.8%. The Abu Saafa oilfield was an offshore oilfield that was owned jointly by the Governments of Bahrain and Saudi Arabia and was operated by Saudi Arabian Oil Co. (Aramco). In 2008, Bahrain's share of the Abu Saafa oilfield was increased by 127,000 barrels to 54.8 Mbbl.

Bahrain's gross gas production increased by 6% in 2008 compared with that of 2007 whereas production of dry gas increased by 21%. The volume of aluminum output in 2008 remained virtually the same as in 2007. Petrochemical production increased by 12.5% in 2008 compared with that of 2007, including an 11% increase in methanol output and a 38% increase in nitrogen fertilizer output. Refined oil production was slightly less in 2008 than in 2007. Direct-reduction iron oxide pellets were produced from imported iron ore (primarily from Brazil) by the Gulf Industrial Investment Co. (GIIC's) "merchant" plant at the Hidd Industrial Area and exported to steel plants in India, Indonesia, Iran, Malaysia, Qatar, and Saudi Arabia.

Commodity Review

Metals

Aluminum.—Alba was considered one of the most important companies in the Middle East by Middle East Economic

[1]The Gulf Cooperation Council countries are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

[2]Where necessary, values have been converted from Bahraini dinars (BhD) to U.S. dollars (US$) at the rate of BhD0.376=US$1.00.

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Digest in 2009. The company, which contributed about 12% of Bahrain's GDP, continued to exceed its rated capacity of 860,000 metric tons per year (t/yr) from five potlines. Alba produced four types of aluminum: standard ingots, and larger T-ingots, billet, and rolling slabs. Alba imported more than 1 million metric tons per year (Mt/yr) of alumina. In February 2008, Alba filed a $1 billion law suit in U.S. Federal court against Alcoa Inc. of the United States, which supplied Alba with alumina from Alcoa's mines in Western Australia; Alba claimed that Alcoa had been overcharging Alba for alumina for 15 years (Van Voris and Crofts, 2008; Middle East Economic Digest, 2009a, b).

Alba's proposed expansion plan, which included adding a sixth potline to raise production capacity to 1.2 Mt/yr, was put on hold because of the lack of a dedicated source of natural gas to provide power for the new line. (Alba consumed 25% of the total gas used in Bahrain in 2008.) The lack of a dedicated supply of gas as well as a recent decline in revenue remained major impediments to the expansion project's development (Thomson Reuters, 2009a).

Iron and Steel.—Bahrain's imports of steel products had tripled in the period between 2003 and 2006. Bahrain imported only 12,300 t of steel products in 2007, however, which was 4.3% of the 284,900 t that was imported in 2006. GIIC, which was wholly owned by Foulath, produced direct-reduction iron oxide pellets from iron ore that was imported mainly from Brazil at its plant in the Hidd Industrial Area. The production capacity of the Allis-Chalmers (Grate-Kiln) pelletizing plant was 5 Mt/yr (Gulf Industrial Investment Co. (E.C.), 2009; Middle East Economic Digest, 2009d).

United Stainless Steel Co. B.S.C., which was a Foulath subsidiary, produced 100,000 t/yr of steel at its plant in the Hidd Industrial Area. Universal Rolling W.L.L., which was owned by Bahraini and Saudi investors and the Bahrain-based International Investment Bank, moved forward with building the country's first steel reinforcement bar mill at the Hidd Industrial Area. Production was expected to start in 2009 at an annual capacity of 200,000 t of rebar (Steel Guru, 2009; Thomson Reuters, 2009b).

In 2008, a joint venture of GIIC and Yamato Kogyo Co. Ltd. of Japan was formed to build a 1.5-Mt/yr-capacity direct-reduction iron plant at the Hidd Industrial Area. GIIC held 51% interest in this venture, and Yamato held the remaining 49% interest. Foulath planned to build four 7-Mt/yr-capacity iron ore pellet plants; one would be located at the Hidd Industrial Area next to the existing plant operated by GIIC; one would be located at Salalah in Oman as a joint venture with JFE Steel Corp. of Japan; and the remaining two plants would be built at Alexandria and Suez in Egypt. The total (combined) production capacity of Foulath's five plants would be 33 Mt/yr by the year 2012. To secure a stable supply of iron ore, Foulath planned to buy stakes in companies that operate iron ore mines in Australia, Brazil, and Europe. Northland Resources Inc. of Sweden signed a memorandum of understanding with GIIC to supply 250,000 t of iron ore concentrates in 2011, 1.5 Mt in 2012, 2 Mt in 2013, and 3 Mt/yr starting in 2014 to be used in the GIIC pelletizing operations (Arab Steel, 2008; Northland Resources Inc., 2009; Steel Guru, 2009; Thomson Reuters, 2009b).

Industrial Minerals

Cement.—Star Cement Co. W.L.L. of the United Arab Emirates was the sole cement producer in Bahrain from its clinker grinding mill at the Hidd Industrial Area; the mill had a 450,000-t/yr cement production capacity. In 2008, Bahrain's per capita consumption of cement averaged 300 kilograms per year (kg/yr), which was the lowest among the GCC countries and about 13% of the GCC countries' average of 2,345 kg/yr (Middle East Economic Digest, 2009c). The shortage of cement in Bahrain in 2007, which was caused by a breakdown of the cement plant in Saudi Arabia that supplied the Bahrain market, prompted Bahrain to build a new cement plant in the country. Falcon Cement Co., which started building a 370,000-t/yr-capacity cement plant in the Hufaira Industrial Area in January 2007, completed construction and commissioned production by yearend 2008 (Zawya, 2009).

Nitrogen.—In 2008, Bapco produced 473,810 t of ammonia and 661,443 t of urea, which was a 38% and a 13% increase, respectively, compared with output in 2007. The volumes of ammonia and urea production in 2008 were the highest annual production levels ever achieved by Bapco. About 80% of the ammonia produced was used for the production of urea (Gulf Petrochemical Industries Co. B.S.C., 2009, p. 10).

Mineral Fuels

Natural Gas and Petroleum.—Bahrain's proven natural gas reserves as of yearend 2008 were estimated by NOGA to be 2.4 billion cubic meters and were projected to be 2.1 billion cubic meters by 2011. Production from the Bahrain field, which was the location of the first oil discovery in the Gulf in 1932, continued its downward trend (Middle East Economic Digest, 2009e). Bapco and Occidental Petroleum of the United States signed an agreement to develop the Bahrain oilfield, which would double the country's petroleum production to 70,000 barrels per day (bbl/d) from 35,000 bbl/d. During the bidding round in 2007, Occidental Petroleum was also granted exploration rights for offshore Blocks 1, 2, and 4, and PTT Exploration and Production Co. Ltd. of Thailand was chosen for oil and gas exploration in offshore Block 3. In March 2008, Bapco and Exxon Mobil Corp. of the United States signed a partnership agreement that commits ExxonMobil to conduct studies to determine Bahrain's future gas needs and the best methods to meet them, taking into consideration alternative energy and the possibility of importing gas from neighboring countries, including Qatar (Zawya, 2008a).

In April 2008, Foster Wheeler Energy Ltd. (a United Kingdom-based subsidiary of Foster Wheeler Ltd. of the United States) was awarded a contract to expand the production capacity of the liquefied petroleum gas facilities of Bahrain National Gas Co. to 15 million cubic meters per day of gas throughput by 2020. In October 2008, NOGA signed a memorandum of understanding with Hess Corp. of the United States to build a liquefied natural gas import terminal in Bahrain. The project was in the feasibility stage (Zawya, 2008b; Middle East Economic Digest, 2009e).

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Bahrain Petroleum's refinery at Sitra, which imported 85% of its crude petroleum from Saudi Arabia by way of two undersea pipelines and one above-ground pipeline, inaugurated a low-sulfur diesel production complex in December 2007 and exported the first shipment of low-sulfur-diesel in May 2008. The company started a second phase of desulfurization that would allow for producing and exporting of ultra-low-sulfur diesel in 2009. In 2008, Bapco began construction of a refinery gas desulfurization plant at a cost of $150 million; construction was expected to be completed in 2009. The plant would significantly reduce sulfur-containing gases emitted by the refinery and subsequently improve air quality in the area (Bahrain Petroleum Co. B.S.C., 2009). GPIC signed an agreement with Abu Dhabi Future Energy Co. of the United Arab Emirates to set up a carbon-emission-reduction facility, which would arrest carbon dioxide gas from flue gas and reuse it in the production of ammonia, methanol, and urea. This process was expected to cut the quantity of carbon dioxide emissions by 100,000 t as of 2010. GPIC was working with Technimont I.C.B. of Italy and Mitsubishi Heavy Industries Ltd. of Japan on the carbon capturing project; it would be the first petrochemical company in the Gulf region to use such technology (Gulf Petrochemical Industries Co. B.S.C., 2008; Petroleum Economist, 2008).

A joint venture of Bapco and Neste Oil of Finland awarded Samsung Engineering Co. Ltd. of the Republic of Korea a $314 million contract to conduct the engineering, procurement, and construction of a lube base oil refinery in Sitra. The project was scheduled to be completed in 2011 (Middle East Economic Digest, 2008a).

Outlook

The mineral industry of Bahrain is expected to continue to benefit from the substantial financial resources available for investment from the GCC countries and from the Kingdom's proximity to Iran, Qatar, Saudi Arabia, and the United Arab Emirates. Bahrain plans to increase its gas and oil reserves and resources, upgrade the Sitra petroleum refinery (the country's only petroleum refinery), revamp its petrochemical plants, and strive to be a major aluminum and steel producer in the Gulf region. Future expansion plans by the aluminum industry in the Gulf region in general and in Bahrain in particular are faced with two major challenges—finding a sustainable source of energy that guarantees a long-term supply of natural gas for the aluminum smelters and securing the bauxite supplies needed to sustain high production levels.

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TABLE 1
BAHRAIN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Aluminum metal, primary		531,626	750,710	860,435	865,048	871,658
Iron ore pellets[3]		3,716,209	4,044,342	5,000,000 e	5,000,000 e	5,000,000 e
INDUSTRIAL MINERALS						
Cement		400,000 r	400,000 r	400,000	400,000	370,000
Nitrogen, N content of ammonia		311,300	329,745	370,393	343,185	473,810
Sulfur		71,258	71,963	70,000	72,000 e	72,000 e
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	12,130	13,320	13,817	14,376	15,241
Dry	do.	9,194	10,278	10,700	11,100	13,400
Methanol		398,406	375,609	406,600	371,000	410,235
Natural gas plant liquids:						
Propane	thousand 42-gallon barrels	1,032	1,065	1,010	944	949
Butane	do.	981	1,015	970	896	920
Naphtha	do.	1,786	1,783	1,725	1,663	1,699
Petroleum:						
Crude[4]	do.	76,337 r	68,096 r	66,908 r	67,262 r	66,864
Refinery products:						
Liquefied petroleum gas	do.	425	452	400	400 e	400 e
Gasoline	do.	6,439	7,309	7,200	7,300 e	7,300 e
Jet fuel	do.	17,268	19,956	19,800	20,000 e	20,000 e
Kerosene	do.	2,436	1,101	1,000	1,000 e	1,000 e
Distillate fuel oil	do.	18,210	19,278	19,000	20,000 e	20,000 e
Residual fuel oil[e]	do.	28,900	29,000	28,500	29,000	29,000
Other[e]	do.	19,000	20,600	20,300	20,200	19,000
Total	do.	92,678 r	97,696 r	96,500 r	97,900 r	96,700

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto.

[1]Table includes data available through December 31, 2009.

[2]Granular urea has been produced from locally produced ammonia since 1998. Aggregate, sand, and rock are also produced, but available information is inadeqate to make estimates of output. Iron ore was pelleted and exported for use by direct-reduction plants.

[3]Pellets were produced from imported iron ore.

[4]Includes production from the Bharain and the Abu Saafa fields.

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TABLE 2
BAHRAIN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum:				
Metal:				
Primary and secondary		Aluminium Bahrain B.S.C. (Alba) (Bahrain Mumtalakat Holding Co., 77%; SABIC Industrial Investments Co. Ltd., 20%; Breton Investments Ltd., 3%)	Smelter at Sitra	860,000 [1]
Secondary		Bahrain Recycling Plant (private, 100%)	Dross and scrap remelt facilities at Askar	NA
Rolled products		Gulf Aluminium Rolling Mill Co. B.S.C. (Closed) (Bahrain Mumtalakat Holding Co., 38%; Saudi Basic Industries Corp., 30%; Industrial Bank of Kuwait, 17%; Gulf Investment Corp., 6%; Government of Iraq, 5%; Government of Oman, 2%; Government of Qatar, 2%)	Rolling mill at Sitra	165,000
Do.		Midal Cables Ltd. (Intersteel W.L.L., 50%, and Saudi Cable Co., 50%)	Rolling mill at Manama	120,000
Cement		Star Cement Co. W.L.L.	Clinker grinding mill at Hidd	450,000
Do.		Falcon Cement Co.	Hufaira	370,000 [2]
Iron and steel:				
Iron ore, pellets		Gulf United Steel Holding Co. (Foulath) (Gulf Industrial Investment Co., 50%; Qatar Steel Co., 25%; Kharafi Group, 10%; National Industries Group, 10%; and Kuwait Foundry Co., 5%)	Pellet plant at Hidd	5,000,000
Steel, stainless, rolled		Universal Rolling W.L.L. (Unirol)	Hidd	200,000
Methanol		Gulf Petrochemical Industries Co. B.S.C. (GPIC) [National Oil and Gas Authority (NOGA), 33.3%; Petrochemical Industries Co., 33.3%; Saudi Basic Industries Corp., 33.3%]	Sitra	438,000
Natural gas:				
Extracted	million cubic meters	Bahrain Petroleum Co., B.S.C. (Closed) (Bapco) (Government)	Bahrain field, Awali	13,900
Liquids:				
Butane	thousand 42-gallon barrels	Bahrain National Gas Co. B.S.C. [National Oil and Gas Authority (NOGA), 75%; Arab Petroleum Investment Corp., 12.5%; Caltex Bahrain, 12.5%]	Natural gas plant at Awali	1,100
Naphtha	do.	do.	do.	1,020
Propane	do.	do.	do.	1,800
Nitrogen:				
Ammonia		Gulf Petrochemical Industries Co. B.S.C. (GPIC) [National Oil and Gas Authority (NOGA), 33.3%; Petrochemical Industries Co., 33.3%; Saudi Basic Industries Corp., 33.3%]	Sitra	438,000
Urea		do.	do.	621,000
Petroleum:				
Synthetic coke		Aluminium Bahrain B.S.C. (Alba) (Bahrain Mumtalakat Holding Co., 77%; SABIC Industrial Investments Co. Ltd., 20%; Breton Investments Ltd., 3%)	do.	600,000
Crude	thousand 42-gallon barrels	Saudi Arabian Oil Co. (Aramco)	Abu Saafa field, offshore	110,000 [3]
Do.	do.	Bahrain Petroleum Co., B.S.C. (Closed) (Bapco) [National Oil and Gas Authority (NOGA), 100%]	Bahrain field, Awali	13,800
Refined products	do.	do.	Sitra	95,600 [1]
Sulfur		do.	do.	72,000

Do., do. Ditto. NA Not available.

[1]Actual annual output regularly exceeds the facility's nominal production capacity.

[2]Under construction.

[3]Production from the field is pumped to Bahrain and subsequently refined and marketed by Bahrain Petroleum Co.

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The Mineral Industry of Iran

By Philip M. Mobbs

Iran's hydrocarbon sector, which included the production of natural gas and oil, the refining of crude oil, and the distribution of hydrocarbons, was a significant facet of the country's economy. The Central Bank reported that crude oil production averaged 4 million barrels per day in 2008. According to BP p.l.c. (2009, p. 9), Iran was the world's fourth ranked producer of crude oil and condensate, accounting for about 5.3% of the world's output. Iran also held 16% of proved worldwide natural gas reserves and 10.9% of proved oil reserves. The country also was estimated to account for more than 1% of the world's output of cement and fluorspar (table 1; BP p.l.c., 2009, p. 6, 22; Central Bank of the Islamic Republic of Iran, 2009, p. 7; Miller, 2010; van Oss, 2010).

Minerals in the National Economy

Iran had an extensive mineral production and processing industry. Production, processing, transportation, and sales of crude oil and natural gas accounted for about 30% of the country's gross domestic product (GDP) at current prices for the first three quarters of 2008 (the latest period for which data were available). At constant prices, hydrocarbons accounted for 9.7% of the country's GDP for the first three quarters of 2008 compared with about 10.3% for the first three quarters of 2007 and about 10.2% for all of 2007. Cement and steel were significant components of the domestic mineral industry. Aluminum, refined copper, and steel ingots accounted for minor, but notable, mineral sector export values and volumes (Central Bank of the Islamic Republic of Iran, 2009, p. 2, 3).

The Government subsidized several segments of the economy, including the electricity, mineral fuel, and natural gas sectors. Gasoline rationing remained in effect in 2008, and the Government-controlled price of gasoline was raised to $0.45 per liter ($1.71 per gallon) from $0.11 per liter ($0.42 per gallon). For Iranian year 1386 (March 21, 2007, to March 20, 2008), the Government lost an estimated $32 billion in revenue because of the motor fuels subsidy and about $25 billion owing to the subsidy for industrial users of natural gas (Kramarenko, Bonato, and Zytec, 2008, p. 26-27).

Government Policies and Programs

The Mining Code of 1998, which was based on Articles 44 and 45 of Chapter 4 of the 1978 Constitution of the Islamic Republic of Iran, and various amendments to the Mining Code, regulated the mining sector. A reinterpretation of the Constitution in 2004 allowed private domestic and international investor participation in the mining sector. The Petroleum Act of 1987 clarified the Government's authority in the oil sector.

Production

Based on estimates of mineral commodity production, significant increases in output in 2008 compared with that of 2007 were estimated for aluminum, gold ore, iron ore, manganese ore, and zinc ore and metal. Other large swings observed in the production data primarily were artifacts of rounding to fewer significant digits. Data on estimated mineral production are in table 1.

Structure of the Mineral Industry

The Ministry of Industries and Mines administered all mining, smelting, and refining industries except the oil and gas sectors, which were administered by the Ministry of Petroleum. Basic geologic exploration and most initial evaluations of the nation's mineral resources (except hydrocarbons) were performed by the Geological Survey of Iran.

Most of the country's more-than-3,000 active mines were privately owned. The Government controlled many of the larger mining and mineral-processing companies, especially those that produced aluminum, ammonia, coal, copper, iron and steel, natural gas, petroleum, salt, and sulfur. In 2008, the Government divested some of its interest in the mineral sector.

A consortium headed by the Industrial Development Investment Co. of Iran and a subsidiary of Mehr Finance & Credit Institution of Iran acquired 40% of Iran Aluminium Co. from the Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO). The Government divested 40% of its interest in Khorasan Steel Co. (which was acquired by a Government pension fund), 30.5% of its interest in Khouzestan Steel Co., and a minority stake in Zagros Steel Co. The Government also divested 25% of its interest in IMIDRO's Mobarekeh Steel Co., of which the Government's Social Security Organization acquired 10%, a subsidiary of Mehr Finance acquired 5%, and the Steel Employees Fund acquired 5%. Five percent of the shares of National Iranian Oil Refining and Distribution Co.'s (NIORDC's) Esfahan Oil Refinery Co. were sold off. The Government also sold Razi Petrochemical Co., which was an ammonia, diammonium phosphate fertilizer, and urea producer, to a group led by Gubre Fabrikalari Turk A.Ş. of Turkey.

In 2009, the Government planned to privatize 100% of its interest in Isfahan Steel Co., 69% of its interest in Almahdi Aluminium Corp., and 49% of its interest in Meibod Steel Co., in addition to partial interest in the Arak, the Bandar Abbas, the Esfahan, the Kermanshah, and the Lavan refineries of National Iranian Oil Co.

Mineral Trade

The Central Bank of the Islamic Republic of Iran (2008, p. 13; 2009, p. 13) reported that hydrocarbons accounted for

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about 84% of the total value of exports in 2008. Hydrocarbon exports were valued at about $95 billion[1] in 2008 compared with $72 billion in 2007. The increase was primarily the result of the increased international price of oil. Crude oil exports accounted for most of the hydrocarbon exports. About 40% of exported Iranian oil (based on value) was shipped to China, India, and Japan.

Commodity Review

Metals

Aluminum.—The second phase of Iran Aluminium Co.'s new smelter at Arak was completed in 2008. The company's total production capacity increased to about 190,000 metric tons per year (t/yr) from 155,000 t/yr (Iran Mining & Related Industries Information Center, 2008b).

Fata SpA of Italy continued work on the Hormozgan aluminum complex (Hormozal) at Bandar Abbas. The 147,000-t/yr-capacity Hormozal smelter was expected to begin production in 2010 (Iranian Mines and Mining Industries Development and Renovation Organization, 2010).

Copper.—National Iranian Copper Industries Co. (NICICO) proposed significant increases in Iran's refined copper production by 2013. Domestic copper cathode capacity was expected to increase to 440,000 t/yr from 224,000 t/yr. Projects underway in 2008 included the construction of a 5,000-t/yr-capacity solvent extraction-electrowon plant at Miduk and the expansion of the capacity of several domestic copper mines to concentrate ore. New concentrators were under construction at the Sarcheshmeh Mine, which was expected to produce 160,000 t/yr of concentrate at a grade of 28% copper, and at the Sungun Mine, which was expected to produce 150,000 t/yr of concentrate at grade of 30% copper. Also underway were the construction of the Yazd Ali-Abad Mine, which was expected to mine 2.5 million metric tons per year of ore to produce 43,000 t/yr of concentrate at a grade of 27% copper, and the 300,000-t/yr Zahedan Chehel-Kooreh Mine, which would produce 17,000 t/yr of concentrate at a grade of 20% copper. NICICO also started the construction of a molybdenum plant at Sungun, which would produce 2,000 t/yr of molybdenum concentrate at an expected grade of 54% molybdenum (Iranian Mines and Mining Industries Development and Renovation Organization, 2008; National Iranian Copper Industries Co., undated a-f).

Mineral Fuels and Related Materials

Coal and Coke.—Production of coke from coal began at the Zarand Iranian Steel Co.'s plant. The 400,000-t/yr-capacity plant, which was located at Zarand, Kerman Province, reached 60% of capacity by yearend. Coke output was sold to the Isfahan, the Meibod, and the Zagros steel plants. The Zarand tar refinery was under construction at the coke plant. The refinery also was designed to produce about 19,200 t/yr of coke byproducts, such as ammonium sulfate, benzol, naphthalene, sulfur, and toluene (Iran Mining & Related Industries Information Center, 2008a).

Petroleum.—NIORDC continued work on numerous refinery projects in 2008. Projects underway included production-capacity expansions of 85,000 barrels per day (bbl/d) of gasoline at the Esfahan refinery, 36,300 bbl/d at the Bandar Abbas refinery, 11,000 bbl/d at the Tehran refinery, 11,000 bbl/d at the Lavan refinery, and 4,500 bbl/d at the Tabriz refinery (National Iranian Oil Refining and Distribution Co., undated).

Outlook

The Government continued the planned reduction of its direct-controlling interest in the economy to 25% from about 75%. Quasi-qovernmental organizations, however, were expected to continue to acquire a significant proportion of the shares in companies that the Government divests.

Numerous development or expansion projects are planned or underway in Iran's mineral sector. Despite the higher-than-expected international prices at the beginning of the year for minerals, the dependence of large-scale mineral resource development programs on Government funding adversely affected the timeliness of mineral development and production-capacity expansion projects. Such project delays historically have resulted in increased construction costs and lost revenue from the projects. The availability of international funding for capital-intensive development of mineral-related projects by Government-controlled and private companies operating in Iran was impaired, in part, by the Government's nuclear program, which had attracted international sanctions.

About 60% of Iranian crude oil production was exported in 2008. Domestic demand for crude oil and natural gas is expected to continue to increase in the future, which may require that Iran forgo income-generating hydrocarbon exports in order to meet demand. Development of identified natural gas and oil resources is expected to continue, subject to funding constraints and limitations imposed by existing (2008) economic sanctions. The renovation of existing crude oil refineries and the construction of several new refineries are expected to increase the value of the Iranian oil output (Central Bank of the Islamic Republic of Iran, 2009, p. 7; U.S. Department of the Treasury, Office of Foreign Assets Control, undated).

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[1]Where necessary, values have been converted from Iranian rials (IR) to U.S. dollars (US$) at the average exchange rate of IR9,638=US$1.00 for 2008.

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TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005[e]	2006[e]	2007[e]	2008[e]
METALS						
Aluminum:						
Bauxite, gross weight		366,000	437,595 [4]	500,000	520,800 [r, 4]	520,000
Alumina		137,002	200,000	250,000	250,000	200,000
Metal, primary ingot		212,602	220,000	205,000	215,981 [r, 4]	248,000
Arsenic, orpiment and realgar, concentrates[e]		89 [4]	100	100	100	100
Chromite, mine output, concentrate:						
Gross weight		138,755	223,563 [4]	244,603 [r, 4]	185,760 [r, 4]	180,000
Cr_2O_3 content[e]		68,000	110,000	115,000 [r]	90,000 [r]	80,000
Copper:						
Mine output:						
Ore mined (0.6% to 1.2% Cu):						
Gross weight	thousand metric tons	18,885	19,000	20,000	26,500	26,500
Cu content[e]		190,000	190,000	210,000	244,000 [r]	248,000
Concentrate (29% to 35% Cu):						
Gross weight		448,689	480,000	620,000	731,000	740,000
Cu content[e]		150,000	160,000	200,000 [r]	235,000 [r]	240,000
Metal:						
Smelter output, blister or anode		184,814	227,000	242,000	250,000	248,000
Refined output, cathode		152,463	178,000	200,000	201,000	200,000
Gold, mine output, Au content[5]	kilograms	195	200 [r]	200 [r]	252 [r, 4]	400
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	18,205	19,000	21,000	23,000	25,500
Fe content[e]	do.	8,900	9,162 [4]	10,000	11,000	12,000
Metal:						
Pig iron	do.	2,136	2,300	2,000	2,572 [r, 4]	2,600
Direct-reduced iron	do.	6,410	6,850	6,900	7,440 [r, 4]	7,500
Ferrochromium[e]		7,750 [4]	8,000	7,000	8,000	8,000
Ferrosilicon		50,140	50,000	45,000	45,000	45,000
Steel, crude, ingots and castings	thousand metric tons	8,382	9,400	9,800	10,100	9,960
Lead:						
Mine output, concentrate:						
Gross weight		42,018	43,000	47,000	40,000	40,000
Pb content[e]		22,000	22,000	24,000	20,000	20,000
Refinery output, includes secondary[e]		68,000	68,000	75,000	70,000	75,000
Manganese, mine output (30% to 35% Mn):						
Gross weight		128,924	125,000	125,000	103,441 [r, 4]	130,000
Mn content[e]		43,000	42,000	42,000	35,000 [r]	44,000
Molybdenum, mine output, concentrate:						
Gross weight		3,367	4,603 [4]	4,600	6,644 [4]	6,500
Mo content[e]		1,800	2,476 [4]	2,500	3,600	3,500
Silver, mine output, Ag content		25	25	25	26	25
Zinc:						
Mine output, concentrate:						
Gross weight		244,006	310,000	300,000	190,000	280,000
Zn content[e]		121,000	167,000	164,000	100,000	150,000
Metal		109,400	120,000	140,000	90,000	100,000
INDUSTRIAL MINERALS						
Asbestos:						
Concentrate (3% to 8% marketable fiber)		82,018	40,000	40,000	-- [r, 4]	--
Marketable fiber[e]		6,000	1,300	1,300	-- [r, 4]	--
Barite		275,607	231,184 [4]	230,000	249,495 [r, 4]	250,000

See footnotes at end of table.

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TABLE 1—Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005[e]	2006[e]	2007[e]	2008[e]
INDUSTRIAL MINERALS—Continued						
Boron, borax		2,142	1,660	2,000	1,603 [r, 4]	2,000
Cement, hydraulic	thousand metric tons	32,198	32,650 [4]	35,000	41,000	44,400
Clays:						
Bentonite		193,046	261,888 [4]	260,000	254,084 [r, 4]	240,000
Industrial clays		578,750	550,000	550,000	550,000	530,000
Kaolin		531,109	311,501 [4]	310,000	350,000	320,000
Diatomite		8,028	1,450	1,500	300 [r]	300
Feldspar		252,713	286,033 [4]	290,000	512,261 [r, 4]	500,000
Fluorspar		54,052	64,601 [4]	65,000	68,192 [r, 4]	65,000
Gemstones, turquoise[e]	kilograms	20,000	20,000	20,000	20,000	20,000
Gypsum	thousand metric tons	12,594	11,196 [4]	12,000	12,000	12,000
Industrial or glass sand (quartzite and silica)		1,880,093	1,900,000	1,900,000	2,000,000	2,000,000
Lime	thousand metric tons	2,500	2,500	2,600	2,600	2,700
Magnesite		88,194	114,708 [4]	110,000	112,229 [r, 4]	110,000
Mica		7,032	705 [4]	--	1,800 [r, 4]	1,800
Nepheline syenite		63,798	65,000	70,000	70,000	70,000
Nitrogen:						
N content of ammonia		1,087,700	1,020,000	1,020,000	2,000,000	2,000,000
N content of urea		717,800	670,000	670,000	1,300,000	1,300,000
Perlite		31,259	31,000	40,000	30,000	30,000
Phosphate rock:						
Ore		229,575	324,166 [4]	325,000	330,000	325,000
P_2O_5 content[e]		28,000	40,000	40,000	40,500	36,000
Pigments, mineral, natural iron oxide, ochre[e]		2,500	2,500	2,600	2,600	2,600
Pumice and related volcanic materials		1,536,448	1,500,000	1,400,000	1,500,000	1,500,000
Salt		1,790,669	2,009,195 [4]	2,000,000	2,564,871 [r, 4]	2,000,000
Soda ash[e]		130,000	130,000	130,000	140,000	140,000
Sodium compound, caustic soda[e]		22,000	22,000	20,000	20,000	20,000
Stone:						
Construction and building, crushed[6]	thousand metric tons	25,369	25,000	25,000	26,000	25,000
Dimension and decorative:						
Granite	do.	1,019	1,000	1,000	1,100	1,000
Marble, blocks and slabs[7]	do.	4,068	4,000	4,000	4,200	4,000
Travertine, blocks	do.	1,360	1,400	1,400	1,500	1,500
Total[e]	do.	6,450	6,400	6,400	6,800	6,500
Dolomite	do.	609	600	600	650	600
Limestone	do.	50,380	50,000	50,000	55,000	50,000
Strontium, celesite		7,500	672	--	--	--
Sulfates, natural:[e]						
Aluminum potassium sulfate (alum)		1,000	1,000	1,000	1,000	1,000
Sodium sulfate		600,000	600,000	600,000	600,000	600,000
Sulfur:[e]						
Byproduct of petroleum and natural gas		1,400,000	1,400,000	1,400,000	1,500,000	1,500,000
Byproduct of metallurgical processing, S content of acid		60,000	60,000	60,000	70,000	70,000
Total		1,460,000	1,460,000	1,460,000	1,570,000	1,570,000
Talc		187,465	70,600	70,000	90,889 [r, 4]	90,000

See footnotes at end of table.

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TABLE 1—Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005[e]	2006[e]	2007[e]	2008[e]
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand metric tons	2,498	1,898 [4]	2,000	2,000	2,000
Coke	do.	1,021	1,020	1,184 [4]	1,200 [4]	1,300
Gas, natural:[e]						
Gross	million cubic meters	137,000	150,000	160,000	170,000	175,000
Dry	do.	89,663 [4]	100,000	105,000	112,000	116,000
Plant liquids	thousand 42-gallon barrels	84,000	85,000	90,000	95,000	95,000
Petroleum:						
Crude	do.	1,500,000	1,493,000 [4]	1,487,000 [4]	1,470,000 [4]	1,490,000
Refinery products:[e]						
Liquefied petroleum gases	do.	48,100	48,000	47,000	48,000	48,000
Motor gasoline	do.	92,000	100,000	103,000	105,000	105,000
Jet fuel	do.	6,300	7,000	8,000	8,000	8,000
Kerosene	do.	52,800	50,000	49,000	50,000	50,000
Distillate fuel oil	do.	117,000	120,000	185,000	190,000	190,000
Residual fuel oil	do.	172,000	170,000	175,000	180,000	180,000
Other	do.	21,000	20,000	16,000	19,000	19,000
Total	do.	509,000	515,000	583,000	600,000	600,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through January 29, 2010.

[2]Data are for Iranian years ending March 20 of that stated, except data for alumina, natural gas, natural-gas-plant liquids, and petroleum, which are for Gregorian calendar years.

[3]In addition to commodities listed, the following may have been produced, but information is inadequte to estimate output: antimony, bromine, crude construction materials (such as sand and shell), ferromolybdenum, hafnium oxide, ilmenite, selenium, silicomanganese, uranium, zeolite, and zirconium metal.

[4]Reported figure.

[5]Includes gold recovered from the Mouteh gold mine and from the Sarcheshmeh copper complex.

[6]Includes marble and travertine.

[7]Includes marmarite.

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TABLE 2

IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Iran Alumina Co. (Government)	Northeast of Jajarm, Khorasan Province	280
Aluminum	Iran Aluminium Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)[3] majority interest, and a joint venture of Industrial Development Investment Co. and a subsidiary of Mehr Finance & Credit Institution, 40%]	Arak, Markazi Province	190
Do.	Almahdi Aluminium Corp. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO),[3] 59.34%, and International Development Corp., 20.78%]	Bandar Abbas, Hormozgan Province	110
Bauxite	Iran Alumina Co. (Government)	Jajarm Mine, about 15 kilometers northeast of Jajarm	500
Cement	Abadeh Cement Co.	Abadeh, Fars Province	175
Do.	Abyek Cement Co. (Fars & Khouzestan Cement Co.)	Abyek, Qazvin Province, 80 kilometers northwest of Tehran	5,100
Do.	Ardebil Cement Co. (Espandar Cement Investment Co.)	Namin, Ardebil Province	1,050
Do.	Ardestan Cement Co.	North of Esfahan, Esfahan Province	1,000
Do.	Behbahan Cement Co. (Fars & Khouzestan Cement Co.)	Behbahan, Khuzestan Province	960
Do.	Benvid White Cement Co. (Bank Melli Iran Investment Co.)	Benvid, Esfahan Province	175
Do.	Bojnourd Cement Plant (Fars & Khouzestan Cement Co.)	About 37 kilometers from Bojnourd, Khorasan Province	700
Do.	Bushehr Cement Co. (Dashtestan Cement)	Borazjan, Bushehr Province	1,000
Do.	Darab Cement Co. [General public (Justice shares), 50%, and Bank Melli Iran Imvestment Co., 29%]	About 190 kilometers southeast of Shiraz, Fars Province	1,100
Do.	Doroud Cement Co. (Fars & Khouzestan Cement Co.)	Doroud, Lorestan Province	1,400
Do.	Ekbatan Cement Co. (Espandar Cement Investment Co.)	Ekbatan, Tehran Province	175
Do.	Estahban Cement Co.	20 kilometers west of Estahban, Fars Province	350
Do.	Faraz Firouzkhuh Cement Co. (Espandar Cement Investment Co.)	About 180 kilometers northeast of Tehran	1,200
Do.	Fars Cement Co. (Fars & Khouzestan Cement Co.)	Shiraz, Fars Province	2,000
Do.	Fars Nov Cement Co. (Fars & Khouzestan Cement Co.)	About 65 kilometers southeast of Shiraz, Fars Province	1,000
Do.	Ghaen Cement Co. (Cement Investment and Development Co., 26%, and Bank Melli Iran Investment Co., 14%)	Qayen (Ghaen), Khorasan Province	770
Do.	Gharb Cement Co. (Fars & Khouzestan Cement Co.)	Kermanshah, Kermanshah Province	700
Do.	Hegmatan Cement Co. (Tehran Cement Co., 79%)	East of Razan, Hamedan Province	1,000
Do.	Hormozgan Cement Co. (OMID Investment Co.)	About 75 kilometers west of Bandar Abbas	2,200
Do.	Ilam Cement Co. (Tehran Cement Co., 47%)	Northeast of Ilam, Ilam Province	700
Do.	Isfahan Cement Co.	Esfahan, Esfahan Province	1,100
Do.	Karoon Cement Co.	Near Masjed Soleyman, Khozestan Province	1,100
Do.	Kavir Kashan Cement Co. (Espandar Cement Investment Co.)	Near Kashan, Esfahan Province	660
Do.	Kerman Cement Co. (Bank Melli Iran Investment Co., 38%)	Kerman, Kerman Province	1,260
Do.	Khash Cement Co. (Fars & Khouzestan Cement Co.)	Khash, Sistan va Baluchestan Province	730 e
Do.	Khazar Cement Co. (Fars & Khouzestan Cement Co.)	About 80 kilometers northwest of Qazvin, Qazvin Province	1,200
Do.	Khouzestan Cement Co. (Fars & Khouzestan Cement Co.)	Ramhormoz, Khuzestan Province	1,100 e
Do.	Kohkiloye Yasuj Cement (State Retirement Organization[3] and Fars & Khouzestan Cement Co.)	Behbehan, near Deh Dasht, Kohkiloye, Kohgiluyeh va Bowyer Ahmad Province	240
Do.	Kordestan Cement Co. (Ghadir Investment Co.)	North of Bijar, Kurdistan Province	1,000
Do.	Loshan Cement Co. (Tehran Cement Co., 66%)	Loshan, Gilan Province	100
Do.	Mazandaran Cement Co. (Bank Melli Iran Investment Co., 60%)	Neka, Mazandaran Province	1,600
Do.	Qeshm Cement Co.	Qeshm Island, Hormozgan Province	250
Do.	Neyriz White Cement Co. (Fars & Khouzestan Cement Co.)	Neyriz, Fars Province	160
Do.	Saveh Grey Cement Co. (Fars & Khouzestan Cement Co.)	Saveh, Markazi Province	2,200
Do.	Saveh White Cement Co. (Fars & Khouzestan Cement Co.)	do.	350
Do.	Sepahan Cement Co. (Ghadir Investment Co.)	Mobarekeh, Esfahan Province	2,300

See footnotes at end of table.

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TABLE 2—Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement—Continued		Shahroud Cement Co. (Fars & Khouzestan Cement Co.)	Shahroud, Semnan Province	600
Do.		Sharg Cement Co. (Ghadir Investment Co.)	Mashhad, Khorasan Province	1,600
Do.		Shemal Cement Co. (Bank Melli Iran Investment Co., 59%)	Pardis, Tehran Province	880
Do.		Soufian Cement Co. (Fars & Khouzestan Cement Co. and Social Security Organization Investment Co.)	About 33 kilometers northwest of Tabriz, East Azerbaijan Province	1,500
Do.		Tehran Cement Co. (Ghadir Investment Co.)	Tehran, Tehran Province	6,000
Do.		Urmia Cement Co. (Fars & Khouzestan Cement Co.)	Orumiyeh, West Azerbaijan Province	740
Do.		Urumieh White Cement Co.	do.	180
Do.		Yazd Bohrouk Cement Co.	Yazd, Yazd Province	1,100
Do.		Zanjan Cement Co. (Fars & Khouzestan Cement Co.)	Zanjan, Zanjan Province	600
Chromite		Faryab Mining Co.	Faryab Mine and processing plant, Minab, Hormozgan Province	180 e
Do.		Esfandaghe Mines Co.	Abdasht Mine, Kerman Province; Suqan (Saboughan) Mine, Kerman Province; Processing plant at Esfandaghe, Kerman Province	30
Do.		NA	Furumad Mine, Shahrud, Semnan Province; Gaft processing plant, Semnan Province	6
Do.		NA	Mir Mahmud Mine, Mayami, Semnam Province	6
Do.		NA	Dumak Mine, Zahedan, Sistan va Baluchestan Province	2
Coke	thousand metric tons	Isfahan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Plant about 40 kilometers southwest of Esfahan, Esfahan Province	900
Do.		Zarand Iranian Steel Co.	Zarand, Kerman Province	400
Copper:				
Concentrate		National Iranian Copper Industries Co. (NICICO) [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Sarcheshmeh Mine, south of Rafsanjan, Kerman Province	670
Do.		do.	Sungun copper mine, East Azerbaijan Province	150
Do.		do.	Miduk copper mine, Kerman Province	150
Do.		do.	Qal'eh Zari Mine, about 120 kilometers southwest of Birjand, Khorasan Province	10
Do.		Private cooperatives	Chah Musa Mine and Qal'eh Sukhteh, Semnan	5
Smelter output		National Iranian Copper Industries Co. (NICICO) [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Smelter, Sarcheshmeh copper complex, south of Rafsanjan, Kerman Province	145
Do.		do.	Smelter near Khatoonabad, Kerman Province	80
Refined metal		do.	Refinery, Sarcheshmeh copper complex, south of Rafsanjan, Kerman Province	210
Do.		do.	Electrowon plant, Sarcheshmeh copper complex, south of Rafsanjan, Kerman Province	14
Gemstones, turquoise		NA	Neyshabur Mine, Khorasan Province	6 e
Gold:				
Ore	kilograms	Iran Gold Co.	Muteh Mine (Chah Khaton and Senjedeh pits), Esfahan Province, and Kuh-e-Zar Mine, Semnan Province	600
Do.	do.	Artisanal placer operations	Neyshabur area, Khorasan Province	NA
Metal[4]	do.	National Iranian Copper Industries Co. (NICICO) [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Sarcheshmeh copper complex, south of Rafsanjan, Kerman Province	500

See footnotes at end of table.

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TABLE 2—Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel:			
Iron ore	Iran Central Iron Ore Co. (National Iranian Steel Co., 100%)[5]	Choghart Mine, Bafgh, Yazd Province	7,400
Do.	Chadormalu Mining and Industrial Co. (Omid Investment Management Corp., 37%; Mines and Metals Development Investment Co., 15%; Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO),[3] 8%)	Chadormalu Mine, 80 kilometers north of Bafgh, Yazd Province	6,500
Do.	Gol-e-Gohar Iron Ore Co. (Omid Investment Management Corp., 39%; Mines and Metals Development Investment Co., 28%; Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO),[3] 18%)	Gol-e-Gohar Mine, about 50 kilometers southwest of Sirjan, Kerman Province	3,800
Do.	Sangan Iron Ore Co. (National Iranian Steel Co., 100%)[4]	Sangan (Songun) Mine, about 140 kilometers southeast of Torbat e-Heydariyeh, Khorasan Province	2,000
Do.	About 50 small privately owned mines	NA	1,000 e
Iron:			
Cast iron	Zagros Steel Co. (Government, majority interest)	Foundry in Kurdistan Province	70
Iron metal	Mobarekeh Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Direct-reduction iron plant (Midrex process) about 50 kilometers southwest of Esfahan, Esfahan Province	4,000
Do.	Khouzestan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)[3] majority interest]	Direct-reduction iron plant (HYL I, Midrex, and Purofer processes), Ahwaz, Khuzestan Province	3,200
Do.	Isfahan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Direct-reduction iron plant (Ghaem process) about 40 kilometers southwest of Esfahan, Esfahan Province	600
Steel, crude	Mobarekeh Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3] majority interest; Social Security Organization,[3] 10%; a subsidiary of Mehr Finance & Credit Institution, 5%, and the Steel Employees Fund, 5%]	Plant about 50 kilometers southwest of Esfahan, Esfahan Province	4,200
Do.	Khouzestan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3] majority interest]	Plant at Ahwaz, Khuzestan Province	2,600
Do.	Isfahan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Plant about 40 kilometers southwest of Esfahan, Esfahan Province	2,200
Do.	Khorasan Steel Co. [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)[3] majority interest; A Government pension fund, 40%]	Plant at Neyshabur, Khorasan Province	650
Do.	Vian Steel Melting and Casting Co.	Plant, about 42 kilometers of Hamadan, Hamadan Province	600
Do.	Meibod (Maybod) Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)],[3] 50%	About 15 kilometers southwest of Meybod, Yazd Province	300
Natural gas billion cubic meters	National Iranian Oil Co. (Government, 100%)	Associated gas from company oilfields	96
Do. do.	do.	Aghar, Dalan, Kangan, and Nar gasfields	57
Do. do.	Pars Oil and Gas Co. (National Iranian Oil Co., 100%)[3]	South Pars gasfields, offshore	32 [6]
Petroleum:			
Crude million 42-gallon barrels	National Iranian Oil Co. (Government, 100%)	Onshore oilfields include the Agha Jari, the Ahwaz-Asmari, the Bangestan, the Hakimeh, the Gachsaran, the Karanj, the Marun, the Pazanan, and the Rag-e-Safid. Offshore oilfields include the Abouzar, and the Salman	1,400

See footnotes at end of table.

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TABLE 2—Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:				
Crude—Continued	million 42-gallon barrels	National Iranian Oil Co. and buyback contract joint venture of Shell Iran Nowrooz/Soroosh Development (70%), JJI S&N B.V. (20%), and Iranian Offshore Engineering & Construction Co. (10%)	Nowrooz and Soroosh fields, offshore	75
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (55%) and Eni SpA (45%)	Doroud field, offshore	65
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (70%) and PETRONAS Carigali International Sdn Bhd (30%)	Sirri A and E fields, offshore	40
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (60%) and Naftiran Intertrade Co. (40%)	Darquain field, onshore	17
Refined products	thousand 42-gallon barrels per day	National Iranian Oil Refining and Distribution Co. (NIORDC) (Government, 100%)	Refineries at Abadan, Arak, Bandar Abbas, Esfahan,[7] Kermanshah, Lavan, Shiraz, Tabriz, and Tehran	1,728
Phosphate rock		Esfordi Phosphate Complex (Iran Minerals Production & Supply Co.)[3]	About 35 kilometers northeast of Bafgh, Yazd Province	500
Titanium, ilmenite		Kahnuj pilot plant [Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO)][3]	Daregaz placer and Kahnuj titanium dioxide processing plant	NA
Uranium	metric tons	Atomic Energy Organization of Iran (Government)	Saghand Mine, about 125 kilometers northeast of Yazd, Yazd Province	50 e
Do.	do.	do.	Gchine Mine, near Bandar Abbas, Hormozgan Province	21 e
Zinc:				
Ore		Iran Zinc Mine Development Co.	Angouran open pit mine, Dandi, Zanjan Province	500 [8]
Do.		BAMA Co. (IranKooh)	Irankouh complex (Gooshfil and Tappeh Sorkh open pit mines, about 20 kilometers southeast of Esfahan, Esfahan Province, and Kolah Darvazeh Mine, south of Esfahan, Esfahan Province)	190 [8]
Do.		Bafgh Mining Co.	Kushk Mine, Yazd Province	120 [8]
Do.		Beroner Tehran Co.	Emarat Mine, about 25 kilometers southwest of Arak, Markazi Province	100 [8]
Refined metal		Bafgh Zinc Co. (Iran Zinc Mine Development Co.)	West of Bafgh, Yazd Province	30
Do.		Qeshm Zinc Smelter Co. (affiliate of Calcimine Co.)	Kaveh Industrial Zone, Qeshm Island, Hormozgan Province	20
Do.		Calcimine Co. (Iran Zinc Mine Development Co.)	Dandi (Angouran) plant, Zanjan Province	18
Do.		Faravari Mavad Madani Iran Co. (Iran Zinc Mine Development Co.)	Dandi, Zanjan Province	18
Do.		National Iranian Lead and Zinc Co. (Iran Zinc Mine Development Co.)	About 12 kilometers east of Zanjan, Zanjan Province	15
Do.		Bandar Abbas Zinc Production Co. (affiliate of Calcimine Co.)	Bandar Abbas, Hormozgan Province	13
Do.		Zanjan Zinc Smelter Co. (affiliate of Calcimine Co.)	Zanjan, Zanjan Province	5

[e]Estimated. Do., do. Ditto. NA Not available.
[1]About 3,000 mines that are located in Iran are active. About 65% of the active mines and quarries produce building and construction materials, such as aggregate, sand, and stone.
[2]Data was augmented by input from the Iranian National Committee of the World Mining Congress.
[3]Government owned.
[4]Recovered from Sar Chemesh copper plant slimes.
[5]A subsidiary of state-owned Iranian Mines and Mining Industries Development and Renovation Organization.
[6]May include basic sediment and condensate.
[7]Held 95% equity interest.
[8]Includes lead and zinc ores.

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The Mineral Industry of Iraq

By Mowafa Taib

The mineral resources of Iraq include base-metal deposits in the Northern Thrust Zone and the Zagros Suture, which are located in the northeast near the borders with Iran and Turkey; nonmetallic minerals and industrial rocks, which are spread throughout the eastern and southern parts of the country; and fuel minerals, which are spread throughout Iraq from the Turkish border in the north to the Gulf and the Kuwaiti borders in the south. Iraq was a significant crude oil producer in 2008; its average production was 2.4 million barrels per day (Mbbl/d), which accounted for 3.0% of the world's crude oil output. The rehabilitation and restoration of the state-owned mineral production enterprises of Iraq following decades of wars and sanctions proceeded at a faster pace in 2008 because of the sharp decline in the level of violence despite the continued weakness in the security situation (Al-Bassam and Hak, 2006, p. 288; BP p.l.c., 2009, p. 8; U.S. Energy Information Administration, 2009).

Minerals in the National Economy

In 2008, Iraq's economy grew at an annual rate of 9.8% at constant 1988 prices compared with a growth rate of only 1.5% in 2007. The hydrocarbon sector was the country's main economic activity and accounted for more than 85% of both the gross domestic product and Government revenue. The value of Iraqi exports in 2008 reached $63.7 billion. Crude petroleum exports accounted for $61.9 billion of the total value and refined petroleum products exports accounted for $1.5 billion. The value of hydrocarbon exports was 61% greater in 2008 than in 2007 because of higher crude petroleum prices, which averaged, for Iraq, $93 per barrel in 2008 compared with $63 per barrel in 2007, and because of the increased volume of exports. Iraq exported more than 708 million barrels (Mbbl) of crude petroleum and refined petroleum products out of the 995 Mbbl the country produced in 2008 (Central Bank of Iraq, 2009, p. 61, 80; International Monetary Fund, 2009, p. 36; Organization of Arab Petroleum Exporting Countries, 2009, p. 19, 57).

A surge of private foreign investment in Iraq took place in 2008 following the significant decline in countrywide violence that began in the fourth quarter of 2007. Twenty-two investment projects valued at about $43 billion were reported in 2008 compared with 17 projects valued at $2.7 billion in 2007. The majority of investments, which were announced in 2008, went to hydrocarbon projects in Basrah, Dohuk, Erbil, and Wasit, and to real estate sector projects in Baghdad, Erbil, and Sulaimanyia (Dunia Frontier Consultants, 2009, p. 13).

Production

In 2008, bentonite production increased by 182%; clay, by 74%; cement, by 43%; refined petroleum products, by 40%; natural gas, by 29%; gravel, by 24%; and crude oil, by 13% compared with the respective production levels in 2007. There was also reported production of about 5,000 metric tons (t) of bauxite for the first time. Data on mineral production are in table 1.

Structure of the Mineral Industry

The Ministry of Oil manages the country's hydrocarbon sector activity and the Ministry of Industry and Minerals (MIM) administers the activity of the nonfuel mineral sector. The State Company of Geological Survey and Mining (GEOSURV), which is an agency of the MIM, conducts studies on Iraq's geology, mapping, and mineral exploration.

The proposed new Iraq Hydrocarbon Law, which was first proposed on February 26, 2007, but did not receive parliamentary approval, was resubmitted to the Gas and Oil Committee of the Iraqi Parliament on October 26, 2008, and was returned without approval to the Council of Ministries. The law would create a national oil company, assign the entities responsible for natural gas and oil exploration, and include formulas for the sharing of oil revenue among the different regions (State Company for the Geological Survey and Mining, 2009; U.S. Department of State, Bureau of Near Eastern Affairs, 2009, p. 8, 9).

Law No. 91 of 1988 and its amendments regulates investment in mining and other natural resources and Investment law No. 13 of 2006 covers all areas of investment other than the oil and gas sector. The Government issued calls for investors to create joint ventures to rehabilitate public industrial enterprises, including cement, fertilizer, float glass, steel, and sulfur plants (Ministry of Industry and Minerals, undated). Table 2 is a list of major mineral facilities.

Commodity Review

Metals

Aluminum.—MIM invited investors to rehabilitate the state-owned aluminum plant of Ur State Company for Engineering Industries in Thi-Qar Governorate, which is located 380 kilometers (km) south of Baghdad. The plant had a production capacity of 16,500 metric tons per year (t/yr), a rolling unit, two extrusion units with a combined capacity of 8,200 t/yr, an anodizing and coloring unit, a 2,845-t/yr-capacity foil unit, and a 10,000-t/yr-capacity foundry unit. The cost of rehabilitation was estimated to be $413 million (Ministry of Industry and Minerals, undated).

Iron and Steel.—In March 2007, MIM called on international investors to modernize and rehabilitate the State Company for Iron and Steel at Khor Al-Zubair in Basrah Governorate, which is located in southern Iraq. ArcelorMittal of Luxembourg and Al-Ittefaq Steel Products Co. of Saudi Arabia had reportedly submitted proposals to rehabilitate the Khor Al-Zubair steel plant to increase the production capacity to 2.9 million metric tons per year (Mt/yr) at a cost of between $500 million and $1 billion (Ministry of Industry and Minerals, undated).

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Industrial Minerals

Cement.—Iraq's cement production from 18 state-owned plants and Lafarge S.A. of France's Bazian plant was estimated to be about 6.44 million metric tons (Mt) in 2008. This level of production was well below the combined design capacity of 23 Mt/yr for the existing plants, and far less than market demand. Iraq's annual production level before 2003 was about 10 Mt, which in turn was below the country's full capacity because the country had been under a decade of economic sanctions by the international community. Iraq reportedly imported 6 Mt of cement from neighboring countries to cover domestic consumption. In 2008, the size of Iraq's cement market was estimated to be 14.5 Mt, and it was expected to grow by 16% in 2009.

The main ingredient in Iraq's cement production—limestone—is found in Iraq mostly near the surface, and it contains a high percentage of calcium carbonate; the limestone occurs throughout Iraq in multiple bands that extend from the northwest to the southeast of the country. Because of the abundance of limestone, cement production has the potential to thrive again in Iraq and the country could again become a cement exporter as it was in the 1980s. For this to happen, other production components, such as power and capital investment, would need to be secured. In 2008, MIM was in the process of reviewing modernization and rehabilitation proposals received for cement plants in Badush, Falluja, Karbala, Kubaisa, and Sinjar (Arabian Business, 2008; Gilani, 2009, p. 8; Lafarge S.A., 2009b, p. 7; Ministry of Industry and Minerals, undated).

Lafarge entered Iraq's cement market following the company's acquisition of Orascom Construction Industries of Egypt in January 2008. Lafarge held majority ownership in two plants at Bazian and Tasluja in northern Iraq. The two plants were located within 30 kilometers of each other and had a combined annual capacity of 5 Mt. Lafarge produced 3.5 Mt of cement from the Bazian and the Tasluja plants in 2008 (Lafarge S.A., 2009a).

Phosphate Rock.—General Phosphate Co., which was one of the state-owned companies under MIM, produced phosphate rock from the Akashat Mine and phosphoric acid, superphosphate fertilizer, and sulfuric acid at the Al-Qaim plant. In 2008, the company sold about 75,000 t of compound fertilizer (Ministry of Industry and Minerals, undated).

Mineral Fuels

Natural Gas.—In October 2008, first gas from the Khor Mor field, which is located in the Kurdistan region of Iraq, was announced by the 50-50 joint venture of Dana Gas PJSC and Crescent Petroleum, both of which were private companies based in the United Arab Emirates. In April 2007, the joint venture signed a strategic alliance protocol and service contract with the Kurdistan Regional Government (KRG) that included an investment of $660 million by the joint venture to produce natural gas and build gas pipelines to supply powerplants for the cities of Erbil and Sulaimaniya in northern Iraq. In July 2008, Gas Cities LLC, which was another joint venture of Dana Gas and Crescent Petroleum, signed an agreement with the KRG to develop Kurdistan Gas City, which would cover an area of 42.8 square kilometers (km^2) and would host manufacturing and petrochemical industries (Dana Gas PJSC, 2008a, b).

In September 2008, Royal Dutch Shell plc (Shell) of the Netherlands and the Ministry of Oil agreed to the formation of a joint venture of state-owned South Gas Co. (51%) and Shell (49%) to market and treat associated gas from a 19,000-km^2 area in the Governorate of Basrah in southern Iraq. Under this 25-year agreement, flared natural gas (estimated to be about 60% of associated gas production) would be captured and used locally as a reliable source of energy; the surplus captured gas would be exported as liquefied natural gas (Royal Dutch Shell plc, 2008; U.S. Energy Information Administration, 2009).

Petroleum.—Iraq's proven petroleum reserves were equivalent to about 10% of the world's reserves. Iraq was the world's third ranked country after Saudi Arabia and Canada in terms of the volume of its petroleum reserves. HIt was believed by many petroleum geologists, however, that Iraq may hold between 45 billion barrels (Gbbl) and 100 Gbbl of recoverable oil on top of the 115 Gbbl of proven reserves. The reasons given for this theory are the presence of unexplored areas in the western and southern deserts and the fact that Iraq's reserves data, which were mostly based on 2-dimensional seismic data from about 30 years ago, had not been changed from 2001 (U.S. Energy Information Administration, 2009).

DNO International ASA of Norway made four new oil discoveries in 2008 and completed the first phase of the Tawke production-sharing contract (PSC) with the KRG in northern Iraq. DNO amended Dohuk, the Erbil, and the Tawke's PSCs, which were signed in 2006, in accordance with the KRG's new petroleum law, which gave DNO a 55% working interest and a 75% paying interest in the Tawke PSC and a 40% paying interest in each of the Dohuk and the Erbil PSCs; the royalty for all three PSCs was set at 10% (DNO International ASA, 2009, p. 24, 28-29, 32, 93).

A consortium led by Korea National Oil Corp. (KNOC) (Government of the Republic of Korea, 100%) signed a $2.1 billion PSC with the KRG in November 2007 for the development of the Hawler, the Qush Tapa, and the Sangaw South fields and the Bazian Block in the Kurdistan region of Iraq. The area covered by the PSC had estimated crude oil reserves of 7.2 Gbbl; the consortium would have the right to produce 1.9 Gbbl of these reserves. Following the withdrawal of some consortium partners, KNOC decided to continue solo in the project and signed a contract with KRG that gave KNOC access to eight oilfields in northern Iraq (IHS Global Insight Inc., 2007; Petroleum Economist, 2008a, p. 36; U.S. Department of State, Bureau of Near Eastern Affairs, 2009, p. 11).

In August 2008, North Oil Co., which was a Government-owned oil company, signed a $3 billion agreement with China National Petroleum Corp. for the development of the Al-Ahdab oilfield, which was expected to increase production to 115,000 barrels per day (bbl/d) from 90,000 bbl/d after 7 years of the 20-year contract (Petroleum Economist, 2008b, p. 36; Sunday Morning Herald, The, 2008).

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Outlook

The Government plans to boost oil production to 12 Mbbl/d by 2016 from the current (2008) production level of 2.4 Mbbl/d and aspires to become the world's leading crude oil producer. More than $100 billion would likely need to be invested by international oil companies to develop the country's oilfields, which are in acute need of modernization. Thus, rehabilitation of other production facilities, such as the General Company of Iron and Steel at Khor Al-Zubair and the State Company for Engineering Industries' Ur aluminum plant in Thi-Qar Governorate could be essential for creating a diversified economy, supplying local aluminum and steel products needed for the development of the gas and petroleum industry, and for rebuilding the country's infrastructure.

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TABLE 1
IRAQ: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
INDUSTRIAL MINERALS						
Bauxite	metric tons	NA	NA	NA	NA	4,928
Bentonite	do.	NA	NA	NA	570 [3]	1,605
Cement, hydraulic:[e]						
Portland		2,500	3,000	3,500	4,500	6,440
White[e]		15	15	15	15	15
Clay[4]		NA	NA	NA	5,871	10,234
Gravel		NA	NA	NA	7,823	9,708
Gypsum[4]		NA	NA	NA	1,848	1,917
Ironstone		NA	NA	NA	40	3
Kaolin		NA	NA	NA	4	2
Limestone[4]		NA	NA	NA	14,753	2,035
Nitrogen, N content of ammonia[e]		30	30	10	10	10
Salt[e]		50	50	50	153 [r]	109
Sand, feldspathic		NA	NA	NA	543	--
Sand, standard		NA	NA	NA	32	26
Silica sand		NA	NA	NA	32	26
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	10,500 [r]	11,350 [r]	11,900 [r]	13,596 [r]	14,781
Dry	do.	1,000 [r]	1,540 [r]	1,450 [r]	1,460 [r]	1,880
Natural gas plant liquids[4]	thousand 42-gallon barrels	11,000 [5]	11,000	11,000	11,000	11,000
Petroleum:						
Crude, including lease condensate	do.	740,950 [r]	669,045 [r]	729,635 [r]	782,560 [r]	884,395
Refinery products:						
Liquefied petroleum gas	do.	18,177 [r]	20,550 [r]	20,550 [r]	6,315 [r]	11,060
Gasoline	do.	14,673 [r]	14,235 [r]	14,856 [r]	17,703 [r]	17,228
Kerosene and jet fuel	do.	15,987 [r]	12,264 [r]	12,264 [r]	9,855 [r]	17,119
Distillate fuels	do.	39,603 [r]	28,105 [r]	28,105 [r]	18,871 [r]	30,551
Residual fuels	do.	79,351 [r]	84,461 [r]	87,089 [r]	58,400 [r]	76,577
Other	do.	19,454 [r]	14,455 [r]	13,836 [r]	5,291 [r]	10,620
Total	do.	187,245 [r]	174,070 [r]	176,700 [r]	116,435 [r]	163,155
Sulfur[5]		20	30	30	30	30

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through December 31, 2009.

[2]In addition to the commodities listed, fertilizer, phosphate rock, secondary aluminum, and secondary lead also may have been produced but available information is inadequate to estimate output.

[3]Reported.

[4]Reported in cubic meters and converted to metric tons.

[5]From petroleum and natural gas processing.

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TABLE 2
IRAQ: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement:			
Portland	Southern Cement Co. (Government, 100%)	Al Jinoob plant, Samawa; Al Najaf Al Ashref plant, Kufa; Al Sadaa plant, near Sadat Al Hindia; Karbala plant, Karbala; Kufa I plant, Kufa; Muthena plant, near Muthena; As Samawa plant, Samawa; and Um Qasr plant, Um Qasr	7,500,000 [1]
Do.	Iraqi Cement Co. (Government, 100%)	Al Qaim plant, Al Qaim; Al Tamim plant, Kirkuk; Fallujah plant, Fallujah; and Kubaisa plant, Kubaisa	5,200,000 [1]
Do.	Northern Cement Co. (Government, 100%)	Badoosh I, II, and III plants, Mosul; Hammam Al Alil I and II plants, Mosul; and Sinjar plant, Mosul	3,740,000 [1]
Do.	Lafarge S.A.	Bazian plant at Sarchinar, near Hayasi	2,700,000 [2]
Do.	do.	Tasluja plant, near Suleimaniyah	2,300,000
White	Iraqi Cement Co. (Government, 100%)	Fallujah white cement plant, Fallujah	300,000 [1]
Fertilizers	State Company for Fertilizers (Government)	Ammonia plant at Abu Al-khasib, near Basra	660,000 [1]
Do.	do.	Urea plant at Abu Al-khasib, near Basra	1,060,000 [1]
Do.	do.	Urea plant at Bayji	500,000
Do.	State Enterprise for Phosphate (Government)	Phosphatic fertilizer plant at Al-Qaim	130,000 [1]
Petroleum:			
Crude	North Oil Co. (Government)	Ain Zaleh, Ajil, Balad, Bai Hassan, East Baghdad, Jambur, Kirkuk, Sufaiya, Tikrit, and West Butmah fields	(3)
Do.	South Oil Co. (Government)	Abu Ghraib, Amara, Burzurgan, Fakka, Halfaya, Luhais, Majnoon, Nahr Umar, North Rumaila, South Rumaila, West Qurna, and Zubair fields	(3)
Refined products[4] 42-gallon barrels per day	Midland Refineries Co. (Government)	Daura refinery at Daura	110,000 [1]
Do. do.	North Refineries Co. (Government)	Baiji (North and Salahudin) refineries at Baiji	310,000 [1]
Do. do.	South Refineries Co. (Government)	Basra refinery at Basra	150,000 [1]
Phosphate rock	General Phosphate Co. (Government)	Akashat	NA
Sulfur	Misraq Sulphur State Enterprise (Government)	Near Al Qayyarah	820,000 [1]

Do., do. Ditto. NA Not available.
[1]Actual production was significantly less than design capacity.
[2]Under construction.
[3]Average production capacity for all Iraqi fields in 2008 was about 2,423,000 barrels per day.
[4]In addition to the three large refineries, several small (2,000- to 12,000-barrel-per-day capacity) topping plants were repaired.

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The Mineral Industry of Israel

By Thomas R. Yager

In 2008, Israel played a significant role in the world's production of bromine, magnesium metal, phosphate rock, and potash. The country's share of the world's bromine production amounted to 41%; potash, 7%; magnesium metal, 4%; and phosphate rock, 2%. Israel accounted for between 40% and 50% of the world's production of monopotassium phosphate and 37% of global potassium nitrate production, which are types of fertilizer. In 2007 (the latest year for which data were available), Israel accounted for 12% of the value of the world's polished diamond production (Even-Zohar, 2008; Apodaca, 2009; Gabison, 2009; Israel Chemicals Ltd., 2009, p. 44; Jasinski, 2009a, b; Kramer, 2009). Other domestically significant mining and mineral processing operations included aggregates, cement, natural gas, and petroleum products. Israel consumed substantial amounts of bromine and phosphate rock in downstream processing operations; most of the final products of these operations were exported.

Minerals in the National Economy

In 2007, the mining and quarrying and nonmetallic mineral products sectors each accounted for about 0.5% of the gross domestic product (GDP), and the manufacture of iron, steel, and other metals, about 0.3%. The remainder of the manufacturing sector (which included diamond cutting and polishing, fertilizer production, and petroleum refining) accounted for 15.9% of the GDP. The nonmetallic minerals sector employed about 9,300 workers, and the mining and quarrying sector, about 3,300. Israel's total exports amounted to $45.9 billion in 2007, of which diamond accounted for 23.9%; mining and quarrying, 1.8%; and nonmetallic mineral products, 0.7% (Central Bureau of Statistics, 2008, p. 614, 675, 704, 760, 765, 767).

Production

In 2008, natural gas production increased by 26%, and magnesium metal, by an estimated 18%. Triple superphosphate production decreased by an estimated 17%; monoammonium phosphate, by an estimated 15%; phosphoric acid, by an estimated 14%; and cut diamond, by an estimated 12%. In 2007, the production of lime increased by 78%. Gypsum output declined by 25%; sulfur, 19%; sand, 14%; and marble, 10% (Oren Gofin, Mines Department, Ministry of National Infrastructures, written commun., September 2, 2008).

Structure of the Mineral Industry

Most of Israel's mining and mineral processing operations were privately owned, including the producers of aggregates, bromine, cement, lime, magnesium, natural gas, phosphate rock, potash, and salt. The state-owned petroleum refineries at Ashdod and Haifa were privatized in 2006 and 2007, respectively.

Commodity Review

Metals

Copper.—In September 2007, Altos Hornos de México S.A. de C.V. (AHMSA) started a pilot mining project at the Timna copper mines. AHMSA planned to reopen the mines, which had been shut down for more than 20 years, and to build a new solvent extraction and electrowinning plant. The company planned to produce and export 22,000 metric tons per year (t/yr) of refined copper; full production was expected by 2010. The cost of the project was estimated to be nearly $200 million (Kliger, 2008).

Magnesium.—Dead Sea Magnesium Ltd. (DSM) [Israel Chemicals Ltd. (ICL), 65%, and Volkswagen AG of Germany, 35%] was producing at its full capacity of 35,000 t/yr of magnesium metal in 2008. The company had the ability to increase capacity by between 2,000 and 3,000 t/yr by removing bottlenecks. In May 2008, DSM announced that it had no plans to increase capacity. In December, Volkswagen announced that it had exercised its option to sell its share back to ICL. The sale was rejected by ICL; the company was considering legal action against Volkswagen (McDonell, 2007; Metal Bulletin, 2008).

Industrial Minerals

Bromine.—Brines and carnallite from the Dead Sea were extracted by Dead Sea Bromine Group (DSBG) (a subsidiary of ICL). In 2008, DSBG produced 164,000 metric tons (t) of bromine compared with 159,395 t in 2007. The company consumed about 70% of its bromine for the manufacture of bromine compounds. DSBG planned to complete its capacity expansion to 280,000 t/yr of bromine from 240,000 t/yr at the beginning of 2009 (Israel Chemicals Ltd., 2009, p. 77, 86).

Diamond.—Israel did not produce rough diamond, but the country was one of the world's leading diamond cutting and trading centers. In 2008, cut and polished diamond exports decreased to $6.24 billion from $7.1 billion in 2007; the decline was particularly severe in December. In the fourth quarter of 2008, most diamond companies reduced employment by about 25%. The downturn in Israel's diamond cutting and trading was attributable to the global economic crisis (Krawitz, 2009).

Magnesium Compounds.—Dead Sea Periclase (DSP) (a subsidiary of ICL) used brines from the Dead Sea to produce specialty grades of magnesium carbonate, magnesium hydroxide, and magnesium oxide at Mishor Rotem. In February 2008, the rated capacity of DSP's plant was 35,000 t/yr; the company was producing at a rate of 40,000 t/yr. DSP planned to expand its capacity to 70,000 t/yr through debottlenecking operations in 2008 and the installation of new equipment by mid-2009 (Industrial Minerals, 2008a).

Phosphate Rock.—Mining of phosphate rock by Rotem Amfert Negev Ltd. (a subsidiary of ICL) remained nearly

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unchanged at about 3.09 million metric tons (Mt) in 2008. Rotem consumed 84% of its output for the manufacture of phosphate fertilizers and phosphoric acid; fertilizer output was about 1.54 Mt in 2008 compared with 1.77 Mt in 2007. Lower fertilizer production was attributable to decreases in worldwide demand. By the end of 2012, the company planned to complete debottlenecking operations that could increase fertilizer capacity by 250,000 t/yr (Israel Chemicals Ltd., 2009, p. 51, 57).

Potash.—Dead Sea Works (DSW) (a subsidiary of ICL) used carnallite from the Dead Sea as raw material for its potash plants. In 2008, DSW increased its production capacity by 250,000 t/yr by using fewer of its brine ponds for salt precipitation and more for carnallite precipitation. The company planned to increase capacity by an additional 250,000 t/yr by 2011; higher capacity would be attributable to removing bottlenecks and improving technology at existing plants. By 2016, DSW planned to increase potash capacity by an additional 1 million metric tons per year (Industrial Minerals, 2008b; Israel Chemicals Ltd., 2009, p. 56).

Haifa Chemicals was the leading consumer of ICL's potash production. The company consumed between 275,000 and 300,000 t/yr of potash in the production of about 500,000 t/yr of potassium nitrate (Gabison, 2009).

Mineral Fuels

Natural Gas.—Noble Energy Inc. of the United States operated the Mari-B gasfield in the Mediterranean Sea through its subsidiary Samedan Mediterranean Sea Inc. In 2008, Noble increased its production of natural gas to about 3.46 billion cubic meters from 2.76 billion cubic meters in 2007. Demand for natural gas increased because of higher consumption by gas-fired powerplants, a desalinization plant, and a paper mill. In the fourth quarter of 2008, Noble started drilling an exploration well on the Tamar prospect (Noble Energy, Inc., 2009, p. 11, 34, 36).

Outlook

Production of bromine and potash is likely to increase in 2009, and copper production is expected to be restarted. Further increases in potash output are expected by 2011, and in phosphate fertilizers, by 2013. The production trends for the cement, crushed stone, and sand industries will depend on the strength of the domestic economy.

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TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES [1]

(Metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008[e]
METALS						
Iron and steel, steel, crude[e]		370,000	480,000	480,000	480,000	480,000
Lead, refined secondary		27,000	28,000	25,000	25,000	25,000
Magnesium metal		28,000	27,853	24,581	29,618	35,000
INDUSTRIAL MINERALS						
Bromine, elemental		202,000	207,048	179,493	159,395	164,000 [3]
Cement, hydraulic	thousand metric tons	4,494	5,093	5,089	5,000	5,000
Clays:						
Brick clay		65,732	54,586	54,925	29,474	30,000
Common clay		850,000	1,072,491	1,003,169	982,000	980,000
Flint clay		--	2,200	6,761	--	--
Diamond[4]	thousand carats	578 [r]	807	642	526	460
Gypsum		124,678	106,798	110,754	82,974	83,000
Lime		113,102	165,894	158,264	282,000	280,000
Magnesium chloride		137,000	134,370	114,333	103,023	100,000
Phosphate:						
Phosphate rock, mine output:						
Beneficiated	thousand metric tons	3,290	3,236	2,949	3,069	3,088 [3]
P_2O_5 content	do.	900	890	810	840	850
Phosphatic fertilizers, P_2O_5 equivalent:[e]						
Monoammonium phosphate		12,000 [3]	12,000	11,000 [r]	13,000 [r]	11,000
Triple superphosphate		170,000 [3]	160,000	160,000 [r]	180,000 [r]	150,000
Phosphoric acid, P_2O_5 equivalent[e]		543,000 [3]	520,000	520,000 [r]	570,000 [r]	490,000
Potash, K_2O equivalent	thousand metric tons	2,138 [r]	2,224	2,187 [r]	2,182	2,300
Salt, marketed	do.	385	406	434	400	400
Sand:						
Silica sand		196,330	196,254	204,190	220,000	220,000
Other[e]	thousand metric tons	6,000	7,000	7,000	6,000	6,000
Stone:[e]						
Crushed	do.	41,000	38,000	43,500	42,000	42,000
Dimension, marble		30,935 [3]	70,000	83,000	75,000	75,000
Sulfur:						
Byproduct from petroleum	thousand metric tons	42	44	42	34 [r]	34
Sulfuric acid:[e]						
Gross weight	do.	1,789 [3]	1,700	1,700	1,700	1,700
S content	do.	581 [3]	550	550	550	550
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	1,193	1,655	2,313	2,758	3,460
Dry	do.	498	686	960	1,145	1,437 [3]
Petroleum:						
Oil shale		439,200	428,900	452,000	450,000 [e]	450,000
Crude	42-gallon barrels	23,135	21,798	24,510	8,200	8,200
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	6,170	5,650	5,461	5,500 [e]	5,400
Gasoline	do.	21,046	21,114	22,108	22,100 [r,e]	22,400
Naphtha	do.	3,722	4,066	3,430	3,400 [e]	3,300
Kerosene	do.	8,555	9,549	9,041	9,000 [e]	9,600
Distillate fuel oil	do.	20,516	22,185	24,104	24,100 [r,e]	26,900
Residual fuel oil	do.	21,098	21,827	21,463	21,500 [r,e]	21,500
Other	do.	1,835	1,696	1,700	1,700 [e]	1,700
Total	do.	82,942	86,087	87,300	87,300 [r,e]	90,800

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through August 12, 2009.

[2]In addition to the commodities listed, caustic sida, copper, magnesia, secondary refined zinc, semimanufactured steel, such fertilizers as potassium nitrate, and a variety of crude construction materials are produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Imported diamond cut in Israel.

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TABLE 2
ISRAEL: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aggregates		Lime & Stone Production Company Ltd. (Housing & Construction Holding Company Ltd., 50%, and Readymix (Israel) Ltd., 50%)	Modiim	6,000[e]
Do.		do.	Dragot, Ein Harod, Eliat, Golani Junction, Kadarim, Revivim, Segev, and Shefar'am	5,000[e]
Bromine		Dead Sea Bromine Group (DSBG) [Israel Chemicals Ltd. (ICL), 100%]	Sdom	240
Cement		Nesher Israel Cement Enterprises Ltd. (Clal Industries and Investments Ltd., 75%)	Plants at Haifa, Har Tuv, and Ramla	6,000
Copper		Altos Hornos de México S.A. de C.V. (AHMSA)	Timna	NA
Flint clay and quartz		Negev Industrial Minerals Ltd. (subsidiary of Doraz D.R.)	Mactesh Ramon	25
Lead, refined, secondary		Harkunas Lead Works	Ashdod	25
Lime		Lime & Stone Production Co. Ltd.	Shefeya	100
Do.		Negev Industrial Minerals Ltd.	Mishor Rotem	90
Magnesium:				
Magnesia		Dead Sea Periclase Ltd. (DSP) [Israel Chemicals Ltd., (ICL) 100%]	do.	35
Magnesium, refined		Dead Sea Magnesium Ltd. (DSM) [Israel Chemicals Ltd. (ICL), 65%, and Volkswagen AG, 35%]	Sdom	35
Natural gas	million cubic meters	Samedan Mediterranean Sea Inc. (Noble Energy Inc., 100%)	Mari-B gasfield	6,200
Petroleum:				
Crude	thousand 42-gallon barrels	Lapidoth Israel Oil Prospectors Corp.	Heletz-Brur	8
Do.	do.	do.	Kochav	3
Refined	do.	Oil Refineries Ltd. (Israel Corp., 45.1%)	Haifa	65,700
Do.	do.	Paz Oil Company Ltd.	Ashdod	32,900
Phosphate:				
Phosphate rock		Rotem Amfert Negev Ltd. [Israel Chemicals Ltd. (ICL), 100%]	Arad, Oron, and Zin	4,500
Phosphatic fertilizers		do.	Rotem	1,800
Do.		Haifa Chemicals Ltd.	Haifa	NA
Phosphoric acid[1]		Rotem Amfert Negev Ltd.	Rotem	640
Do.		Haifa Chemicals Ltd.	Haifa	NA
Potash		Dead Sea Works (DSW) [Israel Chemicals Ltd. (ICL), 100%]	Sdom	3,200
Salt		do.	do.	700
Do.		Israel Salt Industries Ltd. (subsidiary of Danker Group)	Eliat	150
Do.		do.	Kalia	60
Do.		do.	Atlit	16
Sand		Negev Industrial Minerals Ltd.	Mactesh Htira	300
Steel:				
Crude		Hod Metal Products & Manufacturing Co. Ltd.	Akko	300
Do.		Yehuda Steel Ltd.	Ashdod	180
Billet		do.	Bene Ayish	200
Do.		do.	Ashdod	180
Do.		Hod Metal Products & Manufacturing Co. Ltd.	Akko	300
Rebar		Yehuda Steel Ltd.	Bene Ayish	200
Do.		do.	Ashdod	120
Do.		Hod Metal Products & Manufacturing Co. Ltd.	Kiryat Gat	300
Sulfur		Oil Refineries Ltd.	Ashdod	40
Do.		Paz Oil Company Ltd.	Haifa	33
Sulfuric acid		Rotem Amfert Negev Ltd.	Rotem	NA
Zinc		Numinor Chemical Industries Ltd.	Maalot	NA

[e]Estimated; estimated data are rounded to no more than three significant digits. Do., do. Ditto. NA Not available.
[1]P_2O_5 equivalent.

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The Mineral Industry of Jordan

By Mowafa Taib

Jordan was a major producer of bromine, phosphate rock, and potash in 2008. It was the fourth ranked producer of bromine, the seventh ranked producer of phosphate rock, and the ninth ranked producer of potash in the world. Jordan accounted for about 18% of the bromine produced in the world in 2008 (excluding United States output), and 3.6% of the world production of both phosphate rock and potash. Other mineral commodities that were produced in Jordan included cement, clay, fertilizer, kaolin, limestone, pozzolanic material, refined petroleum products, silica sand, steel, and zeolitic tuff (Apodaca, 2009; Jasinski, 2009a, b).

Minerals in the National Economy

In 2008, the mining and quarrying activities in Jordan, at current prices, were valued at $974 million,[1] or 4.9% of the country's gross domestic product (GDP) compared with $407 million, or 2.5% of the GDP, in 2007. The manufacturing sector, which included production of cement, fertilizer, iron and steel, and refined petroleum products, was valued at $3.3 billion (about 16.6% of the GDP) compared with $2.6 billion (15.7% of the GDP) in 2007. Mineral extraction and quarrying was responsible for 11.5% of Jordan's industrial production in 2008 compared with 10.3% in 2007. It included phosphate rock production (5.5%), potash production (5.4%), and hydrocarbon production and quarrying of stone (about 0.3% each). Refined petroleum accounted for 17.7% of Jordan's industrial production; fertilizer, 11.2%; cement, 5.1%; and iron and steel, 3.9% (Central Bank of Jordan, 2009, p. 83, 86).

Government Policies and Programs

The Natural Resources Authority (NRA) was the Government agency responsible for making mineral exploration policy, and for identifying and evaluating mineral resources of potentially high commercial value for investors. The NRA was recently restructured to promote enterprise and bring external and internal investment to the country's mining activity. In 2007, the NRA issued 1,638 mineral export permits, 254 quarrying licenses, and 27 exploration licenses. In 2008, NRA issued 33 exploration permits, which cover an area of 70 square kilometers (km^2), for 8 minerals and mineral-related material, including 10 export permits for gypsum, 8 for limestone, 5 for travertine, 3 each for iron ore and pozzolan, 2 for kaolin, and 1 each for clay and volcanic tuff. The NRA issued 5 new mining licenses, which cover about 9 km^2, and 1,450 export permits during 2008. Oil shale exploration was one of the NRA's top priorities. The NRA had previously identified 23 shallow and deep oil shale deposits in the country that were estimated to hold more than 40 billion metric tons of shale oil. Jordan was the eighth ranked country in the world in terms of the size of its oil shale reserves (Natural Resources Authority, 2006, p. 6; 2008a, p. 34; 2009, p. 21-22).

Production

In 2008, there were notable increases in the production of bromine, calcium carbonate, cement, kaolin, petroleum, phosphate rock, potash, pozzolanic material, salt, travertine, and zeolite tuff. There were also significant decreases in the production levels of aluminum fluoride, basalt, feldspar, gypsum, natural gas, phosphoric acid, and sulfuric acid (table 1).

In 2008, phosphate rock production was 6.27 million metric tons (Mt), which was 13% more than in 2007. This significant increase reversed the downward trend during 2006 and 2007 and returned the country to production levels similar to those achieved in 2004 and 2005. Similarly, potash production increased to 2.0 Mt in 2008, which was 11% more than the 1.8 Mt produced in 2007. In 2008, oil production from the Hamzeh oilfield, which was Jordan's only active oilfield, increased by 82% to 15,600 barrels (bbl) from 8,600 bbl produced in 2007. Natural gas production from the Risha gasfield in 2008 was about 0.6 million cubic meters (20.3 million cubic feet), which was 4% less than in 2007 (table 1).

Structure of the Mineral Industry

Arab Potash Co. Ltd. (APC) and Jordan Phosphate Mines Co. p.l.c. (JPMC) and their subsidiaries dominated Jordan's mineral industry in 2008. Both companies had mixed ownership that included both domestic and international private and public investors. APC shareholders included Potash Corporation of Saskatchewan Inc. of Canada (28%); Jordan's Ministry of Finance (26.9%); Arab Mining Co., which was an Arab League economic establishment (20%); Islamic Development Bank, which was an international donor organization based in Saudi Arabia (5.2%); the Government of Iraq (4.7%); Libyan Arab Foreign Investment Co. (4.1%); Kuwait Investment Co. (3.9%); Social Security Corp. of Jordan (3.8%); and others (3.4%). The main shareholders of JPMC as of yearend 2008 were Kamil Holding Ltd. (37.0%), Jordan's Ministry of Finance (26.3%), Social Security Corp. of Jordan (16.0%), the Government of Kuwait (9.3%), Passport Global Mater Fund SPCL Ltd. (2.7%), and Islamic Development Bank (1.4%) (Arab Potash Co. Ltd., 2009, p. 38; Jordan Phosphate Mines Co. p.l.c., 2009, p. 32).

JPMC employed 3,816 people in 2008; about 30% of the employees were stationed at the Eshidiya Mine, 29% were stationed at the Export Department and the industrial fertilizer complex at Aqaba Port, 20% were at the Al-Hassa Mine, 10% were at the Al-Abyad Mine, 9% were at the headquarters in Amman, and 2% were at the Russiefa Mine. In 2008, APC had 1,956 employees; 88% of them worked at the Safi plant, 8% were at the headquarters in Amman, and 4% were at Aqaba Port

[1]Where necessary, values have been converted from Jordanian dinar (JD) to U.S. dollars (US$) at the rate of JD0.714=US$1.00.

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(Arab Potash Co. Ltd., 2009, p. 32; Jordan Phosphate Mines Co. p.l.c., 2009, p. 55).

Jordan Lafarge Cement Factories Co. P.S.C. (JCFC) had been the sole producer and distributor of cement in the Kingdom since 1951. JCFC was majority owned by Lafarge, which held 50.28% of the total shares, and private Jordanian investors, who owned the remaining shares. The company held a monopoly on the cement market of Jordan until 2008 when Jordanian investors and producers from Egypt, Kuwait, and Saudi Arabia started projects to build several cement factories throughout Jordan (International Cement Review, 2009).

In 2008, Jordan Steel Co. p.l.c. became the sole owner of Consolidated Jordanian Iron and Steelworks Co. after increasing its interest to 100% from 50%, which was achieved by a 51.1% increase in Jordan Steel's capital (Jordan Steel Co. p.l.c., 2008).

Mineral Trade

In 2008, the total value of merchandise exports, which accounted for 5.5% of the gross domestic product (GDP) of Jordan, increased by about 36% compared with that of 2007, which was 4.1% of the GDP. Fertilizer, phosphate rock, and potash exports were the major commodities that made up Jordan's exports whereas crude oil and petroleum products and iron and steel were the major categories of Jordan's imports. In 2008, potash exports accounted for 12.4% of total exports compared with 7.1% in 2007. Exports of fertilizer accounted for 9.5% of Jordan's exports in 2008 compared with 6.8% in 2007; and phosphate rock and phosphoric acid exports accounted for 8.4% and 4.0% of total exports in 2008 compared with 4.3% and 1.6% in 2007, respectively.

In 2008, the total value of merchandise imports, which represented 10.6% of the GDP, increased by 23% compared with the value in 2007, which was 8.6% of the GDP. The growth in merchandise imports included a 21.8% increase in the category of mineral fuels, lubricants, and related materials, and a 5.1% increase in iron and steel imports (Natural Resources Authority, 2008b, p. 15; Central Bank of Jordan, 2009, p. 67, 69, 86).

In 2008, phosphate rock exports were about 4 Mt, which was 10% more than exports in 2007. Exports of diammonium phosphate (DAP), which were largely received by India, decreased to 612,000 metric tons (t) in 2008 from 642,000 t in 2007. Similarly, exports of phosphoric acid declined to 38,000 t from 50,000 t. The destination of Jordan's phosphate rock exports were India, Indonesia, Japan, Korea, the Netherlands, and Taiwan (Jordan Phosphate Mines Co. p.l.c., 2009, p. 13-16, 28).

About 48% of the potash produced by APC was exported by way of Aqaba Port; 9.7% was used by the local market; 4.7% was consumed by Arab Fertilizers and Chemical Industries Ltd. (KEMAPCO); and 1.8% was used by Nippon Jordan Fertilizer Co. (NJFC). The major importing countries of Jordanian potash were India (43%), Malaysia (12%), China (11%), Indonesia (4%), and Egypt and Japan (3% each) (Arab Potash Co. Ltd., 2009, p. 22).

In 2008, there was a 4.4% decline in the demand for cement in Jordan's local market owing to the slowdown in the activity of the construction sector. This decline enabled JCFC to export 355,000 t of cement; of this amount, 87.7% was received by Syria, 11.6% by Iraq, and 0.6% by Sudan (Jordan Lafarge Cement Factories Co. P.S.C., 2009, p. 10).

Commodity Review

Industrial Minerals

Bromine.—Jordan Bromine Co. (JBC) was a 50-50 joint venture between Albemarle Corp. of the United States and APC. JBC, which began production in 2003, produced more than 1 Mt of bromine in 2008, which was a 24% increase compared with that of 2007. Bromine products were sold through Albemarle based on a long-term marketing agreement between APC and Albemarle under which APC received 30% of JBC's profits and endured 50% of its losses (Al-Arabi Investment Group, 2009, p. 14; Arab Potash Co. Ltd., 2009, p. 28).

Cement.—JCFC operated two cement plants; one was located at Fuheis, near Amman, and the other was located in southern Jordan at Ar-Rashadiya. JCFC, which had its own terminal at Aqaba, was responsible for 97% of the Kingdom's cement production. The remaining 3% was produced by the Arab Company for White Cement Industry (ACWCI). ACWCI was a state-owned company that produced 130,000 metric tons per year (t/yr) of white cement. ACWCI was a joint venture of Syrian and Jordanian Government-owned investment companies, including the Syrian Jordanian Company for Industry, the General Company for Cement and Building Materials of Syria, Jordan Investment Corp., and the Social Security Corp. of Jordan (Arab Company for White Cement Industry, 2009).

The high cost of fuel, which accounted for 70% of the total production cost in 2008, triggered JCFC to search for alternative sources of energy to power its cement plants. The company conducted studies to reduce cost and found out that the company could reduce its production costs by 20% if it were to replace 25% of the fuel oil it used with shale oil, which is abundantly available in many locations in Jordan (International Cement Review, 2009).

In May 2008, the construction of the first phase of the Northern Region Cement plant began with an initial capacity of 1 million metric tons per year (Mt/yr). The plant would produce three types of cement: ordinary portland cement, pozzolan cement, and sulfate-resistant cement. In August 2007, Arabian Cement Co. of Saudi Arabia contracted KHD Humbold Wedag International Ltd. of Germany to build a 2-Mt/yr-capacity plant at Qatranah near the city of Karak. Modern Cement and Mining Co. (a subsidiary of Manaseer Group for Industries and Commercial Investments of Jordan) contracted FLSmidth & Co. A/S of Denmark to supply the design and equipment for the cement plant being built northeast of Qatranah about 80 kilometers (km) south of Amman. The plant would have a production capacity of 1.2 Mt/yr of clinker and would begin producing portland cement, pozzolanic cement, and sulfate-resistant cement in 2010.

Al-Rajhi Investment Co. of Saudi Arabia began building two cement plants with a total capacity of 4 Mt/yr; one of the plants was located at Mafraq near the Iraqi border, and the other was located at Qatranah. Additional plans to build

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cement plants in Jordan were announced by Al-Rijal Investment of Kuwait, Cimentos de Portugal S.G.P.S. S.A. (Cimpor), Jordanian-Kuwaiti Holding Co., and Jordan Investment Trust p.l.c. Because of these projects, cement production capacity would more than double by 2011 to 10 Mt/yr (International Cement Review, 2009).

Phosphate Rock.—Sixty-one percent of the phosphate rock produced in Jordan was from the Eshidiya Mine, which is located in the south of Jordan about 125 km northeast of Aqaba Port and which had an estimated 1,321 Mt of proven, probable, and possible reserves. The other two mines—the Al-Abyad Mine and the Al-Hassa Mine—contributed about 19% of total phosphate rock production each. Production from the Russeifa Mine accounted for 0.7%. Rock phosphate was transported either by trucks (60%) or by railroad (40%). JPMC planned to build an exclusive phosphate exporting port at Aqaba on the Red Sea. The new port, which was being planned in coordination with Aqaba Development Corp. and the Aqaba Special Economic Zones Authority, was scheduled to be completed in 2012. JPMC was evaluating the feasibility of establishing a 200-t/yr-capacity phosphoric acid plant in Indonesia, which would be jointly operated with state-owned PT Petrokimia Gresik of Indonesia (Jordan Phosphate Mines Co. p.l.c., 2009, p. 10).

In 2008, Jordan Abyad Fertilizers and Chemicals Co. P.S.C. (JAFCCO) announced a $90 million fertilizer production expansion project at the Aqaba Industrial Complex. The project was expected to increase diammonium phosphate production capacity to 1 Mt/yr from 650,000 t/yr. JAFCCO moved forward with construction of the company's fertilizer manufacturing complex that was begun in August 2007. The complex, which was expected to commence production in April 2010, is located at Al-Abyad Valley near the Al-Abyad phosphate rock mine. It was to include five production lines for the manufacturing of calcium chloride, dicalcium phosphate, potassium sulfate, sulfuric acid, and triple superphosphate. JAFCCO was a partnership among JAFCCO Bahrain (42.8%), JMPC (15%), Venture Capital Bank (14.4%), Al-Fares Investments (12.8%), Arab Mining (10%), and Sea Field Offshore Co. (5%) (Arab Mining Co., 2009, p. 39).

Jordan Indian Fertilizer Co., which was a joint venture of Indian Farmers Fertilizers Cooperative of India (52%) and JPMC (48%) moved forward with building a plant at the Eshidiya Mine; the plant was expected to produce 475,000 t of phosphoric acid and 1.5 Mt of sulfuric acid annually and would begin production in late 2011 at a cost of $570 million. A similar project had been discussed with Mitsubishi Corp. of Japan to produce 325,000 t of phosphoric acid from a second plant also to be located in Eshidiya (Jordan Phosphate Mines Co. p.l.c., 2009, p. 55).

Potash.—APC proceeded with expansion of its operations, which was aimed at increasing its production capacity by 450,000 t to reach a total annual production capacity of 2.5 Mt of potash. APC also intended to increase its compaction capacity by 250,000 t and its storage capacity at the Aqaba Port and the Safi facility by 115,000 t. The cost of the expansion project was estimated to be $280 million, and it was scheduled to be completed by yearend 2009.

Mineral Fuels and Related Materials

Natural Gas and Petroleum.—Jordan has historically depended heavily on such neighboring countries as Iraq and Saudi Arabia to satisfy its increasing consumption of oil products, which was estimated to be 108,000 barrels per year. In 2008, the NRA signed several memorandums of understanding and production-sharing agreements with several companies to invest in oil and gas exploration in Jordan and in oil shale exploitation. These companies included Global Petroleum Ltd. of Australia, Petrel Resources p.l.c. of Ireland, Porosity Ltd. of Jordan, Sonoran Energy Inc. of the United States, and Universal Energy Corp. of India (Natural Resources Authority, 2009, p. 25).

A preliminary agreement between NRA and BP p.l.c. of the United Kingdom was signed to increase gas production from the Risha gasfield located in the eastern part of the country near the border with Iraq. Production from the Risha gasfield began in 1989 and its current production (2008) was 0.6 million cubic meters per day (210 million cubic meters per year) after peaking at 1 million cubic meters per day in 2003. The deal, which would allow BP to produce and export gas from Jordan after forming a joint venture with National Petroleum Co. of Jordan, was expected to be finalized in 2009 (Middle East Economic Digest, 2009).

In May 2008, the Natural Resources Authority signed a major concession agreement with Jordan Oil Shale Co. B.V. (a subsidiary of Royal Dutch Shell p.l.c. of the Netherlands) to explore for oil from oil shale resources in Jordan, which had been estimated to be more than 40,000 Mt. The agreement, which was ratified by the Parliament in July 2008, covered a 22,000-km^2-area and could produce thousands of barrels per day (bbl/d) of oil. Under this agreement, Jordan Oil Shale Co. would get 60% of any oil or gas produced up to 10,000 bbl/d of oil or oil equivalent. The share after 10,000 bbl/d would be scaled down to 35% of oil production that exceeds 100,000 bbl/d (Oil & Gas Journal, 2008; Rigzone.com, 2008).

Uranium.—Jordan's Committee for Nuclear Strategy planned to produce 30% of the country's electricity needs by 2030 and envisaged beginning energy generation from a nuclear powerplant by 2015. Therefore, the Government held talks with the Governments of France, Romania, Russia, the United Kingdom, and the United States regarding this issue. In December 2008, the Government signed a memorandum of understanding with Korea Electric Power Corp. of the Republic of Korea to conduct a feasibility study to build a nuclear powerplant. Another agreement between the Jordan Atomic Energy Commission and the U.S. Department of Energy (DOE) was signed to build a radioactive waste facility, which would be designed and built by Pacific Northwest Laboratory of the DOE. Another related agreement was signed between Jordan Nuclear Regulatory Commission and the DOE's National Nuclear Security Administration on December 16, 2008, to prevent smuggling of nuclear and radioactive material into Jordan by installing radiation sensors and other related equipment at the Port of Aqaba and other border crossing points (U.S. National Nuclear Security Administration, 2008; World Nuclear News, 2009).

JMPC, in coordination with Jordan Nuclear Energy Commission, contracted an unnamed international company in

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June 2008 to conduct a feasibility study to determine the best industrial method to recover the uranium present in phosphate rock. Phosphoric acid produced at the JPMC fertilizer plant would be used for uranium extraction given that uranium concentration is in the range of 50 to 100 parts per million. Extracted uranium would be used to make the yellow cake used as a fuel component in the nuclear powerplants (Jordan Phosphate Mines Co. p.l.c., 2008). The NRA estimated the uranium reserves at four desert locations in Jordan to be 80,000 t and the commercial uranium quantities in the phosphate rock reserves to be 140,000 t (Ragheb and Khasawneh, 2010, p. 15).

Outlook

Jordan, which does not have significant oil and gas resources, is planning to diversify its energy portfolio to meet its national energy needs by building a nuclear powerplant by 2015 and by beginning to mine its abundant oil shale deposits. Jordan plans to maintain and perhaps increase the volume of bromine, fertilizer, phosphate rock and potash production in 2009 and beyond once the expansion projects currently underway are completed.

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TABLE 1
JORDAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity	2004	2005	2006	2007	2008
Bromine	46	90	95	85	106
Calcium carbonate	477	320	304	328	415
Cement, hydraulic	3,908	4,046	3,967	4,138	4,284
Clay:					
Common clay	608	618	643	948	762
Kaolin	217	168	113	101	181
Feldspar	13	1	11	10	3
Fluorine, aluminum fluoride	10	9	12	11	9
Gypsum	135	344	334	288	232
Lime	7	15	12	12	15
Limestone, pure	--	370	448	482	1,840
Magnesia	24	--	--	--	--

See footnotes at end of table.

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TABLE 1—Continued
JORDAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
Natural gas, dry	million cubic meters	294	241	251	219 r	210
Petroleum:						
Crude	42-gallon barrels	10,372	8,540	10,047	8,578 r	15,604
Refinery products:						
Liquefied petroleum gas	do.	1,299	1,369	1,451	1,245	1,250 e
Lubricants	do.	310	200	101	118	118 e
Gasoline	do.	4,938	5,280	5,530	5,787	5,790 e
Jet fuel	do.	1,578	2,569	2,385	2,304	2,300 e
Kerosene	do.	1,252	1,786	1,016	1,075	1,080 e
Distillate fuel oil	do.	9,116	10,407	9,878	9,047	9,050 e
Residual fuel oil	do.	10,097	9,764	8,781	8,024	8,020 e
Asphalt	do.	1,150 e	1,100 e	1,014	942	942 e
Total	do.	29,700 e	32,500 e	30,156	28,542	28,500 e
Phosphate:						
Phosphate rock, mine output:						
Gross weight		6,188	6,375	5,805	5,552	6,266
P_2O_5 content		1,980	2,040	1,860	1,780	2,002
Phosphatic fertilizers		887	800	882	851	802
Phosphoric acid		606	587	554	480	445
Potash:						
Crude salts		1,941	1,829	1,699	1,796	2,005
K_2O equivalent		1,180	1,115	1,036	1,090	1,223
Salt		29	30	29	17	25
Sand:[2]						
Silica		73	229	392	628	23,342
Other		27,088	23,375	4,150	4,370	4,400 e
Steel:[e]						
Crude		140	150	150	150	150
Semimanufactured		310	350	360	360	360
Stone:						
Basalt	thousand cubic meters	7	--	9	21	5
Dimension:						
Worked	thousand meters	6,507	6,071	5,688	5,657	6,053
Marble	do.	28	44	38	41	44
Gravel and crushed rock:						
Basalt	thousand cubic meters	7	--	9	3 r	1
Granite	do.	--	4	4	4	4
Marble	do.	28	44	38	27 r	29
Other	do.	15	16	14	15	14
Pozzolanic material		455	424	552	495	538
Travertine		4	11	9	3	6
Zeolite tuff		3	2	4	2	11
Sulfuric acid:						
Gross weight	thousand metric tons	1,103	1,047	1,092	1,022	933
S content	do.	361	342	357	334	305

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.
[1]Table includes data available through August 31, 2009.
[2]Reported as cubic meters and converted to metric tons.

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TABLE 2
JORDAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Aluminum fluoride		Jordan Phosphate Mines Co. p.l.c. (JPMC) (Kamil Holding Ltd., private, 37%; Jordan Finance Ministry, 26.3%; Social Security Corp., 16%; Kuwait Investment Corp., 9.3%; Passport Global Master Fund SPC Ltd., 2.8%; Islamic Development Bank, 1.4%)	Aqaba	14
Bromine		Jordan Bromine Co. [Arab Potash Co. Ltd. (APC), 50%, and Albemarle Corp., 50%]	al-Safi	10
Cement		Jordan Cement Factories Co. Ltd. (LaFarge Group, 50%)	Fuheis and Ar-Rashadia	4,600
Do.		Arab Company for White Cement Industry	Amman	130
Feldspar		General Mining Co. Ltd.	Al-Jaishiah	10
Gypsum		Al-Nisr/Ali Manaseer	Mujib	89
Do.		Jordan Lafarge Cement Factories Company P.S.C.	River Zarqa	73
Do.		Public Mining Co. Ltd.	Mujib	68
Do.		Al-Nasr Mining Establishment	do.	31
Do.		Falahat Mining Establishment	do.	25
Do.		Shaker Al-Talib Establishment	Subeihi	15
Do.		Al-Noor Mining Co.	Mujib	11
Kaolin		Jordanian Company for Mining and Processing of Kaolin and Feldspar	Qanasieh	216
Do.		Al-Faori Enterprise for Mining	Al-Adasieh	110
Do.		Public Mining Company Ltd.	Fuahais	38
Do.		do.	Batn el-Ghoul	31
Magnesia[2]		Jordan Magnesia Co. [Arab Potash Co. Ltd. (APC), 55.3%]	al-Safi	24
Natural gas	million cubic meters	National Petroleum Co. (Government, 100%)	Risha	210
Petroleum:				
Crude	thousand 42-gallon barrels	do.	Hamza	16
Refined	do.	Jordan Petroleum Refinery Co. Ltd. (Government, 100%)	Zarqa	36,500
Phosphate:				
Phosphate rock		Jordan Phosphate Mines Co. p.l.c. (JPMC) (Kamil Holding Ltd., private, 37%; Jordan Investment Corp., 29%; Social Security Corp., 14%; Kuwait Investment Corp. 9%)	Al-Abiad, Al-Hassa, Eshidiya, and Russeifa Mines	7,000
Phosphatic fertilizers		Jordan Phosphate Mines Co. p.l.c. (JPMC)	Aqaba	650
Do.		Nippon Jordan Fertilizer Co. [Asahi Industries Company Ltd. 10%; Mitsubishi Corp., 10%; Mitsubishi Chemicals Corp., 10%; Zen-Noh, 30%; Arab Potash Co. Ltd. (APC), 20%; Jordan Phosphate Mines Co. p.l.c. (JPMC), 20%]	Eshidiya	300
Phosphoric acid		Jordan Phosphate Mines Co. p.l.c. (JPMC)	Aqaba	350
Do.		Indo-Jordan Chemicals Co. [Southern Petrochemical Industries Corp. Ltd., 52.2%, and Jordan Phosphate Mines Co. p.l.c. (JPMC), 34.8%]	Eshidiya	225
Potash		Arab Potash Co. Ltd. (APC) (Potash Corporation of Saskatchewan Inc., 28%; Government, 26.9%; Arab Mining Co., 20%)	al-Safi	1,950
Potassium nitrate		Arab Fertilizers and Chemicals Industries Ltd. [Arab Potash Co. Ltd. (APC), 100%]	Aqaba	150
Pozzolanic material		Jordan Lafarge Cement Factories Co. P.S.C.	Tel Remah	350
Do.		do.	Rashahdieh	150
Salt		Arab Potash Co. Ltd. (APC), 100%	al-Safi	17
Sand, silica		Middle East Regional Development Enterprises	Ras al-Naqab	530
Do.		Mahmoud Habahbeh and Sons Quarry	do.	28
Do.		Al-Rehab for Industrial Services and Trading	do.	27
Do.		Al-Fares for Silica Sand Mining	do.	17

See footnotes at end of table.

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TABLE 2—Continued
JORDAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Steel:			
Crude	Jordan Steel Co. p.l.c.	Amman	360
Semimanufactured	do.	do.	300
Do.	National Steel Industry Co.	Awajan	100
Do.	Other steel producers	NA	506
Sulfuric acid	Jordan Phosphate Mines Co. p.l.c. (JPMC)	Aqaba	1,100
Do.	Indo-Jordan Chemicals Co.	Eshidiya	660

Do., do. Ditto. NA Not available.

[1]Estimates for feldspar, gypsum, kaolin, pozzolanic material, and silica sand producers based on maximium production for 1 year between 2000 and 2007.

[2]Shut down in 2004.

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The Mineral Industry of Kuwait

By Philip M. Mobbs

Kuwait's economy was structured around the production and refining of hydrocarbons. The hydrocarbon sector accounted for 95% of total exports and about 94% of Government revenue. Kuwaiti crude oil reserves accounted for about 8.1% of the world's proven crude oil reserves (BP p.l.c., 2009, p. 9; Central Bank of Kuwait, 2009, table A).

Under Article 21 of the Constitution, the state owns all natural resources. Article 152 of the Constitution authorizes limited-time-period concessions for the exploitation of natural resources. Decree law No. 6 of 1980 authorizes Kuwait Petroleum Co. to form partnerships with other companies for petroleum sector activity. Environmental issues (including those associated with the manufacturing of aluminum, gold, and steel articles; cement production and storage; and the exploration for, production of, storage of, and transport of natural gas, petroleum, and sand) are covered by law No. 21 of 1995, law No. 16 of 1996, and decision No. 210 of 2001. Executive bylaw of law No. 2 of 2008 amends Kuwait income tax decree No. 3 of 1955 and reduces the income tax to 15% from 55%.

In 2008, total exports (free on board) were valued at $87 billion,[1] of which oil exports accounted for about $82.7 billion. In 2007, the value of exports was $62 billion, of which oil exports accounted for a revised $59 billion. The significant increase in the international market price of crude oil through mid-year accounted for a significant proportion of the 31% increase in the value of Kuwaiti exports in 2008 compared with that of 2007 (in terms of dinars; in dollar terms, the increase was about 40%). The monthly average price of Kuwaiti oil exports in 2008 was about $90.54 per barrel; the average price ranged from $85.63 per barrel in January to $127.57 per barrel in July, before dropping to $36.47 per barrel in December. In 2007, the price of Kuwaiti oil exports averaged $66.35 per barrel. The total value of imports (which included cost, insurance, and freight paid to the point of destination) in 2008 was estimated to be about $24.9 billion compared with a revised $21.3 billion in 2007 (Organization of the Petroleum Exporting Countries, 2008, p. 50; 2009b, p. 82; Central Bank of Kuwait, 2009, table A).

Production

According to BP p.l.c. (2009, p. 9) data, Kuwait produced 3.5% of the world's crude oil in 2008. Data on estimated mineral commodity production are in table 1.

Structure of the Mineral Industry

Kuwait Petroleum Corp. (KPC), the Ministry of Oil, and the Supreme Petroleum Council are the Government organizations that are responsible for the petroleum sector in Kuwait. For the past few years, there has been significant friction between the Government and the National Assembly (the Parliament) concerning economic issues, such as allowing the participation of international oil companies in the expansion of the production capacity of the northern oilfields and the selection of contractors for the construction of an oil refinery at Al-Zour (Ali, 2008; Nield, 2008b).

Kuwait Oil Co. K.S.C., which was a subsidiary of state-owned KPC, managed the country's crude oil and natural gas operations. Kuwait Gulf Oil Co., which was a subsidiary of KPC, managed primarily offshore crude oil and natural gas operations in the Partitioned Neutral Zone, which also is known as the Divided Zone, between Kuwait and Saudi Arabia. Petrochemical Industries Co., which was a subsidiary of KPC, dominated the Kuwaiti fertilizer sector, and Kuwait National Petroleum Co., which was a subsidiary of KPC, operated the country's petroleum refineries. State-owned Kuwait Investment Authority held interests in Kuwaiti cement companies and manufacturers of steel pipe.

Commodity Review

Mineral Fuels

Natural Gas.—Most Kuwaiti gas production was associated with crude oil production. As a member of the Organization of the Petroleum Exporting Countries (OPEC), the volume of Kuwait's crude oil output was subject to a production ceiling, which effectively limited natural gas output. From January through October, the OPEC production allocation for Kuwait was 2,105,000 barrels per day (bbl/d), and in November and December, 1,973,000 bbl/d. Total crude oil production from Kuwait, which averaged about 2.7 million barrels per day, was higher than the OPEC quota because of Kuwait's share of production from the Partitioned Neutral Zone. The Government continued talks with Iran on the importation of natural gas by subsea pipeline and on maritime border issues (Petroleum Economist, 2008; Organization of the Petroleum Exporting Countries, 2009a, p. 8).

In June, the initial production of nonassociated gas from the Sabriyah field began at the rate of about 5 million cubic meters per day (or 1.8 billion cubic meters per year). Kuwait Oil's planned second phase of the nonassociated gas production program was expected to increase natural gas production by about 6 billion cubic meters per year by 2011 and by about 10 billion cubic meters per year by 2015. The nonassociated gas was substituted for fuel oil that had been used to fire the electricity-generating powerplants in Kuwait (MEED, 2008).

Petroleum.—Kuwait Oil continued its efforts to expand its production capacity to 4 million barrels per day (Mbbl/d) by 2020. Projects included the development of heavy crude oil resources, enhanced oil recovery from currently producing

[1]Where necessary, values have been converted from Kuwaiti dinars (KD) to U.S. dollars (US$) at the rate of KD0.269=US$1.00 for 2008 and a revised KD.284=US$1.00 for 2007.

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fields, and the expansion of the production capacity of the northern oilfields. Members of Parliament counter-proposed that crude oil production should be limited to the ratio of reserves to production in the fiscal years 2004-06 to maintain income for Kuwaitis in the future. Official oil reserve data were not released by the Government, but reserves were estimated to be about 99 billion barrels, which would limit future production to less than 3 Mbbl/d under the Parliament's proposal (Kuwait Times, 2007; Petroleum Economist, 2008).

Kuwait Oil projected that production of heavy oil (which is crude oil with a density of between 934 kilograms per cubic meter and 1,000 kilograms per cubic meter) could reach 700,000 bbl/d by 2020. In 2007, an initial agreement was signed that secured Exxon Mobil Corp. of the United States' assistance with a heavy oil recovery project, but by yearend 2008, no contract was signed. Much of Kuwait's crude oil output was produced by primary methods, such as the use of reservoir pressure to propel the crude to the surface. Enhanced oil recovery methods, such as the injection of alkaline fluids, carbon dioxide, steam, and surfactants into the reservoirs, were expected to significantly increase the recovery of oil remaining in the reservoirs of a number of Kuwaiti oilfields (Schenk and others, 2006; Al-Kafeef and Zaid, 2007).

The long-delayed Project Kuwait, which was a program proposed in 1997 to expand the capacity of the northern oilfields to 900,000 bbl/d from 450,000 bbl/d with the assistance of international oil companies, remained a point of contention between the Government and the Parliament. The Government had created Oil Development Co. as a subsidiary of KPC to manage technical service agreements associated with the project. In the past 8 years, operating without international technical assistance, Kuwait Oil had increased output from the northern oilfields to about 650,000 bbl/d (Melly, 2009).

In the Partitioned Neutral Zone, Kuwait and Saudi Arabia expected to increase oil production to more than 620,000 bbl/d by 2009 from about 550,000 bbl/d in 2008. Additionally, Kuwait Gulf Oil proposed a 5-year $3.6 billion investment program to further increase production capacity in the Partitioned Neutral Zone. A successful conclusion of the Government's maritime border talks with Iran could lead to the development the offshore Dorra gasfield, which straddles the disputed border (Rigzone.com, 2003; Petroleum Economist, 2009).

Controversy continued to plague the proposed 615,000-bbl/d-capacity crude oil refinery at Al-Zour. Although the dispute with Saudi Arabia concerning the proposed location in southern Kuwait near the Partitioned Neutral Zone was settled in 2008, the Kuwaiti Parliament criticized the process that Kuwait National Petroleum used for awarding bids for contracts to construct the $14.5 billion project, which originally was projected to cost $6 billion when proposed in 2001. The bids were submitted for review to the State Audit Bureau in August, and the issue remained pending at yearend. The delay with the Al-Zour refinery contracts also delayed the proposed $18 billion Clean Fuels Project, which was the planned upgrade and modernization of the Mina Abdullah and the Mina Al-Ahmadi refineries; the project was expected to expand the refineries' combined production capacity to 800,000 bbl/d (Nield, 2008a; Kuwait Times, 2009).

Outlook

To meet environmental and proposed power demands, Kuwait's electrical power generation plants will require significantly more natural gas than Kuwait currently produces. The development of the nonassociated natural gas deposits would partially reduce the impediment that the limited supply of natural gas had posed for industrial diversification and expansion in Kuwait. Whereas a significant expansion of the Kuwaiti petroleum industry has been under consideration for the past decade (subject to the OPEC crude oil production allocation), the differences in political opinion within the country concerning the future of the Kuwait's economy will likely need to be resolved before the expansion of the petroleum sector can continue.

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TABLE 1
KUWAIT: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Cement		2,635,000 [4]	2,145,000 [4]	2,200,000 [4]	2,200,000	2,200,000
Iron and steel:						
Crude		200,000	450,000	500,000	500,000	500,000
Rolled-steel bar		369,000	480,000	680,000	680,000	680,000
Lime, hydrated and quicklime		40,000	49,800 [4]	50,000 [4]	50,000	50,000
Natural gas:[5]						
Gross	million cubic meters	11,860 [4]	14,200 [r]	14,500 [r]	14,000 [r]	14,800
Dry	do.	9,800	12,200 [r]	12,500 [r]	12,100 [r]	12,800
Nitrogen:						
N content of ammonia		413,400 [4]	466,570 [4]	495,000	485,000	485,000
N content of urea		341,020 [4]	365,350 [4]	428,000	430,000	430,000
Petroleum:						
Crude[5]	thousand 42-gallon barrels	837,655 [4]	939,276 [4]	960,000 [r]	940,000 [r]	990,000
Natural gas liquids and liquefied petroleum gases	do.	39,920 [4]	37,887 [4]	40,000 [r]	38,000 [r]	44,000
Refinery products:						
Gasoline, motor[6]	do.	77,000 [r]	77,000 [r]	80,000 [r]	76,000 [r]	80,000
Kerosene	do.	53,133 [4]	59,054 [4]	61,000 [r]	61,000 [r]	65,000
Distillate fuel oil	do.	101,000 [r]	98,000 [r]	102,000 [r]	96,000 [r]	96,000
Residual fuel oil	do.	74,000 [r]	72,000 [r]	67,000 [r]	75,000 [r]	69,000
Other[7]	do.	16,000 [r]	17,000 [r]	20,000 [r]	19,000 [r]	19,000
Total	do.	321,000 [r]	323,000 [r]	330,000 [r]	327,000 [r]	329,000
Salt		10,200 [4]	8,100 [4]	13,200 [4]	14,000	14,000
Sulfur:						
Elemental, petroleum byproduct		682,000	700,000	650,000	660,000	700,000
Sulfuric acid		18,000	18,000	18,000	18,000	18,000

[r]Revised. do. Ditto.
[1]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through November 2, 2009.
[3]In addition to commodities listed, secondary aluminum, chlorine, clays, petroleum coke, glass, methanol, steel reinforcing bar, and sand and gravel were produced, but available information is inadequate to make reliable estimates of output.
[4]Reported figure.
[5]Includes Kuwait's share of production from the Partitioned Neutral Zone.
[6]Includes naphtha.
[7]Includes bitumen, coke, liquefied petroleum gases, and propylene.

TABLE 2
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum, secondary	Arabian Light Metals Co. K.S.C. (Kuwait Industries Co. Holding K.S.C.)	Ahmadi	NA
Cement:			
Clinker	Kuwait Cement Co. K.S.C. (Kuwait Investment Authority, 32%, and National Industries Group, 22.4%)	Kilns at Shuaiba	1,800,000
Grey portland	do.	Mills at Shuaiba	2,200,000
Do.	Hilal Cement Co. K.S.C.C. (Suez Cement Co., 51%)	Sulaibiya industrial area	(1)
Do.	Portland Cement Co. K.S.C.C.	Shuwaikh	(1)
White	Kuwait Cement Co. K.S.C. (Kuwait Investment Authority, 32%, and National Industries Group, 22.4%)	Kiln and mill at Shuaiba	170,000

See footnotes at end of table.

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TABLE 2—Continued
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel, steel:				
Crude		Al Oula Steel Manufacturing Co.	Shuaiba	500,000
Do.		United Steel Industrial Co. K.S.C.C. (Joint venture of local investors and Ahwaz Steel Commercial and Technical Services GmbH)	Melt shop at Shuaiba	800,000
Rolled				
Bar and rod		do.	Rolling mill at Shuaiba	500,000 [2]
Do.		Kuwait Reinforcement Steel Manufacturing Co. (Ali Al-Sarraf International Group Co.)	do.	400,000
Pipes		Kuwait Pipes Industries and Oil Services Co. K.S.C.	Pipe mill at Sulaibiya industrial area	120,000
Do.		do.	Pipe mill at Shuwaikh	65,000
Natural gas	million cubic meters	Various[3]	Various fields	16,000
Natural gas liquids		Kuwait Oil Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	do.	45,000 [4]
Nitrogen:				
Ammonia		Petrochemical Industries Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	Plant B, Shuaiba	657,000
Urea		do.	Plants A and B, Shuaiba	639,000
Petroleum:				
Coke, calcined		do.	Shuaiba	350,000
Crude	42-gallon barrels per day	Kuwait Oil Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	Southern and eastern fields (Burgan, Khasman, and Madina fields)	1,350,000
Do.	do.	Al-Khafji Joint Operations (Kuwait Gulf Oil Co., 50%, and Aramco Gulf Operations Co., 50%)	Khafji field, offshore Partitioned Neutral Zone	600,000
Do.	do.	Kuwait Oil Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	Northern fields (Abdali, Bahra, Ratqa, Matraba, Raudhatain, and Sabiya fields)	559,000
Do.	do.	do.	Western fields (Abdaliya, Kra' Al-Mero, Managish, and Umm Gudair fields)	427,000
Do.	do.	do.	South Fuwaris and South Umm Gudair fields, onshore Partitioned Neutral Zone	80,000
Do.	do.	Kuwait Oil Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%] and Saudi Arabian Chevron Inc. (Chevron Corp., 100%)	Wafra field, onshore Partitioned Neutral Zone	80,000
Do.	do.	Kuwait Gulf Oil Co. [Kuwait Petroleum Corp. (KPC), 100%]	Hout field, offshore Partitioned Neutral Zone	NA
Refined products	do.	Kuwait National Petroleum Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	Mina Al-Ahmadi refinery	452,000
Do.	do.	do.	Mina Abdulla refinery	270,000
Do.	do.	do.	Shuaiba refinery	198,000
Salt		Al Kout Industrial Projects Co.	Shuaiba	NA
Sulfur		Kuwait National Petroleum Co. K.S.C. [Kuwait Petroleum Corp. (KPC), 100%]	Mina Abdulla, Mina Al-Ahmadi, and Shuaiba refineries	NA
Do.		Kuwait Sulphuric Acid Co.	Safat	18,000

Do., do. Ditto. NA Not available.
[1]Marketed imported bulk cement.
[2]Nominal design capacity. Since 2006, actual production has exceeded design capacity.
[3]Some natural gas is produced and recovered from most crude oil production operations in Kuwait and the Partitioned Neutral Zone. Nonassociated natural gas was produced from the Sabriyah field.
[4]Includes refinery-produced liquefied petroleum gases.

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The Mineral Industry of Lebanon

By Mowafa Taib

The rehabilitation of the Lebanon's infrastructure and commercial and residential buildings that were damaged during the war with Israel in the summer of 2006 continued in 2008 amid an 18-month political standoff and sporadic sectarian and political violence. The estimated $3.6 billion in infrastructure damage had prompted international donors to pledge nearly $1 billion for recovery and reconstruction and more than $7.6 billion for development projects and budget support. Political stability following the Doha Accord of May 2008 and the subsequent election of a new President boosted economic activity and, together with the country's strong banking sector, enabled Lebanon's real gross domestic product (GDP) to grow by 7.5% in 2007 and 8.5% in 2008 compared with 0.6% in 2006, despite the global and regional economic downturn (U.S. Department of State, 2009; U.S. Central Intelligence Agency, 2010).

Production

The mineral commodities that were produced in Lebanon in 2008 included cement, gypsum, lime, limestone, phosphoric acid, phosphate fertilizer, salt, steel, and sulfuric acid (table 1).

Structure of the Mineral Industry

Producers of mineral commodities in Lebanon were entirely private companies. With the exception of the cement industry, which attracted international investors, primary and secondary mineral production of such mineral commodities as construction sand, granite, and marble were produced by small- to medium-size local companies. Phosphatic fertilizers, phosphoric acid, and sulfuric acid were produced by Lebanon Chemicals Co. Cement producers included Holcim (Liban) S.A.L., which was majority owned by Holcim Ltd. of Switzerland; Cimenterie Nationale S.A.L., which was owned by private individuals; and Secil-Companhia Geral de Cal e Cimento S.A. (Secil) of Portugal, which had majority interest (50.5%) in Lebanon's third ranked cement company, Ciment de Sibline S.A.L; and Cimenterie du Moyen-Orient, which was owned by Seament S.A.L. The Ministry of Environment had been using a geographic information system to survey about 1,000 rock, sand, and stone quarries throughout the country (up to 400 of which were unlicensed) and developing prioritization criteria for rehabilitating quarries and identifying the best rehabilitation practices for each quarry (Bathish and Zeineddine 2007; Farah, 2007).

Mineral Trade

The value of Lebanese exports increased by 24% in 2008 to $3.48 billion compared with $2.82 billion in 2007. Industrial exports, which were valued at $3.31 billion, represented 95% of total exports. Pearls and precious and semiprecious stones accounted for 16.5% of total exports; iron and steel, 6.2%; and fertilizer, 6.2%. In 2008, the United Arab Emirates was the leading recipient of Lebanese exports and accounted for 10.0% of total exports, by value, followed by Switzerland, Iraq, Syria, and Saudi Arabia.

The value of goods imported by Lebanon in 2008 increased to $16.14 billion from $11.82 billion in 2007, or by 37%. Mineral fuel imports accounted for 25.3%; pearls and precious and semiprecious stones, 5.3%; and iron and steel, 4.9%. The United States, which was the leading exporting country to Lebanon, accounted for $1.85 billion, or 11.5% of the value of total imports, followed by China and France, which accounted for 8.6% and 8.3%, respectively. The value of imports of petroleum products was estimated to be $3.88 billion in 2008 compared with $2.55 billion in 2007. The increase was largely because of higher crude oil prices in 2008. In 2007, the top exported products by Lebanon were gold, gold plated with platinum, ferrous waste and scrap, remelted scrap ingots of iron and steel, and cement (Ministry of Finance, 2009, p. 34).

Commodity Review

Metals

Iron and Steel.—Updated information on the status of the plan by Al Tuwairqi Group of Saudi Arabia to build a new rolling mill in Lebanon was not available at the time of this writing. In 2007, the company had announced a plan to produce rebar from imported billet by building a new 500,000-metric-ton-per-year-capacity rolling mill at a cost of $300 million (Metal Bulletin, 2007).

Industrial Minerals

Cement.—In 2008, Lebanon's cement production was reported to be 4.20 million metric tons (Mt), which was 6% more than the 3.9 Mt that was produced in 2007. Holcim produced 2.2 Mt of cement in 2008 compared with 2.3 Mt in 2007 and 2.1 Mt in 2006. Holcim transferred a fraction of the clinker it produced at its Chekka plant near Beirut to its plant in Cyprus where the clinker was ground and sold to European markets. Holcim had been increasing the use of phosphogypsum and other mineral components to meet its environmental and social responsibilities towards achieving sustainable development in the Beirut Metropolitan Area. The company reported using 31,184 metric tons (t) of phosphogysum in 2008 compared with 18,734 t in 2007. Holcim also reported using 359,724 t of mineral components as a substitute for clinker in 2008 compared with 305,095 t in 2007.

Société Libanaise des Ciments Blancs, which was majority owned by Holcim Ltd., was the sole producer of white cement in Lebanon. The company produced 102,000 t of white cement in 2008 compared with 92,000 t in 2007.

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Secil, which owned 98.72% of Société Ciments de Gabès in Tunisia, increased its stake in Lebanon's third ranked cement company (Ciment de Sibline) to 50.5% from 28.64% in 2007. In 2008, Secil produced about 1 Mt of cement at its plant in Sibline; 93% of the cement produced there was sold locally and 7% was exported (Secil-Companhia Geral de Cal e Cimento S.A., 2009). Cimenterie Nationale completed the upgrade of the fourth kiln at its Chekka plant, which increased the plant's clinker production capacity to 2.1 million metric tons per year (Mt/yr) from 1.6 Mt/yr (Cimenterie Nationale S.A.L., 2009).

Mineral Fuels

Natural Gas and Petroleum.—Lebanon's reserves of natural gas and petroleum as of yearend 2008 were zero, and the Zahrani and the Tripoli refineries remained closed. These refineries were the first refineries to have been built in the region, and they had been shut down since 1989 and 1992, respectively. Lebanon's rate of petroleum consumption in 2008 increased to 93,000 barrels per day, which caused an increase in the volume of refined petroleum products imports to more than 4 Mt. Lebanon was scheduled to begin receiving natural gas from Egypt through the Arab Gas Pipeline in 2010 to power its electricity plants and those industries that use natural gas as a source of fuel (Bank Audi S.A.L., 2010; U.S. Energy Information Administration, 2010).

Outlook

The Lebanese economy is proving to be resilient following the 2006 war with Israel as it had proven to be in the aftermath of the civil war of 1975 to 1990. The mineral industry in Lebanon is expected to grow significantly as long as internal and regional stability initiatives are implemented in the next 5 years. Stability would make it possible for foreign and local investors to rehabilitate the Tirpoli and the Zharani oil refineries; establish an up-to-date steel plant; expand fertilizer production, which uses the nearby Syrian phosphate rock; increase production of cement, gypsum and lime; and secure an adequate supply of electrical energy needed by the industrial sector in particular and the public in general.

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TABLE 1
LEBANON: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
Cement, hydraulic	thousand metric tons	4,400	4,600	3,348 [r, 4]	3,945 [r, 4]	4,200
Gypsum		30,000	30,000	30,000	30,000	30,000
Lime		14,000	14,000	14,000	14,000	14,000
Limestone, for cement	thousand metric tons	5,900	5,900	5,900	6,500	6,500
Phosphate:[5]						
Phosphatic fertilizers		85,000 [5]	85,000	85,000	85,000	85,000
Phosphoric acid		175,000 [5]	180,000	180,000	180,000	180,000
Salt		3,500	3,500	3,500	3,500	3,500
Sulfuric acid:						
Gross weight		495,000 [5]	500,000	500,000	500,000	500,000
S content		162,000 [5]	164,000	164,000	164,000	164,000

[r]Revised.
[1]Estimated; estimated data are rounded to no more than three significant digits.
[2]Table includes data available through December 31, 2009.
[3]In addition to the commodities listed, sand are gravel and other construction materials are also produced, but quantities are not reported, and available information is inadequate to make reliable estimates of output.
[4]Reported
[5]P_2O_5 equivalent.

TABLE 2
LEBANON: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Holcim (Liban) S.A.L. (Holcim Ltd., 52%)	Chekka	2,600
Do.		Cimenterie Nationale S.A.L.	do.	2,100
Do.		Ciment de Sibline S.A.L. (Secil-Companhia Geral de Cale e Cimento S.A., 50.5%; Bank Med, 20%; Walid Jumblat, 20%)	Sibline	1,277
Do.		Cimenterie du Moyen-Orient (Seament S.A.L.)	Chekka	500
Do.		Société Libanaise des Ciments Blancs (Holcim Ltd., 52%)	do.	100
Gypsum		Sodap Liban S.A.L.	Hosrayel, Jebeil	30
Lime		Societe des Chaux et Platres du Liban S.A.L.	Chekka	NA
Petroleum, refined	thousand 42-gallon barrels	Ministry of Industry and Petroleum[1] (Government, 100%)	Tripoli	12,800
Do.		Ministry of Industry and Petroleum[2]	Zahrani	6,400
Phosphate fertilizers		Lebanon Chemicals Company S.A.L.	Selaata	165
Phosphoric acid		do.	do.	NA
Steel		Consolidated Steel Lebanon S.A.L.[3]	Amchit	300
Sulfuric acid		Lebanon Chemicals Company S.A.L.	Selaata	580

Do., do. Ditto. NA Not available.
[1]Shut down in 1992.
[2]Shut down in 1989.
[3]Shut down in 2002.

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The Mineral Industry of Oman

By Mowafa Taib

Mineral production played an important role in Oman's economic development and growth in 2008. Oman was the seventh ranked crude oil producer in the Middle East and accounted for about 0.9% of total world crude oil production. In addition to hydrocarbons, Oman produced aluminum, chromite, clay, copper, gold, gypsum, iron ore, limestone, marble, quartz, salt, silver, and steel (BP p.l.c., 2009, p. 8).

Minerals in the National Economy

Oman's economy grew at rate of 44% at current prices in 2008 compared with 13% in 2007 and 19% in 2006. The hydrocarbon sector accounted for 51.3% of the gross domestic product (GDP) compared with an average contribution to the GDP of 46% in the previous 4 years. The nonpetroleum industrial sector, which for Oman included manufacturing and mining, accounted for 16% of the GDP. In 2008, Oman's total merchandise exports were valued at about $37.6 billion[1] compared with $24.6 billion in 2007, or an increase of about 53%. The increase was attributable mainly to higher crude oil prices in 2008, which for Oman averaged $101.10 in 2008 compared with $65.15 in 2007. Exports of crude oil in 2008 were valued at about $21.8 billion; liquefied natural gas, about $4.2 billion; refined petroleum products, about $2.6 billion; mineral products, about $1.6 billion; chemical industry products, about $796 million; and base-metals and articles manufactured from base metals, about $427 million. Significant increases in the value of commodity exports in 2008 compared with those of 2007 included chromite ores and concentrates (634%), refined petroleum products (116%), liquefied petroleum gases (54%), crude oil (52%), refined copper wire (44%), nonmetallic mineral products (39%), and base-metals (36%) (Central Bank of Oman, 2009, p. 16, 18, 94-96).

The value of Omani imports was $22.8 billion in 2008, of which mineral fuels accounted for $610 million and crude minerals, about $391 million. In 2007, the value of total imports was $15.9 billion, of which mineral fuels accounted for $555 million and crude minerals, $297 million. In 2008, the Government's net oil revenue increased to $13.7 billion from $9.5 billion in 2007, and Government's gas revenue increased to $2.4 billion in 2008 from $2.1 billion in 2007 (Central Bank of Oman, 2009, p. 47, 99; Ministry of National Economy, 2009, p. 179).

Production

In 2008, there were notable increases in Oman's mineral production compared with that of 2007, including output of sand and gravel, which increased by 297%; clay, by 139%; chromite, by 92%; marble, by 47%; cement, by 9%; and crude oil with condensates, by 7%. There were also significant decreases in the production of silver, by 83%; gold, by 66%; quartz, by 17%; and refined copper, by 15%. Production levels for cement, gypsum, natural gas, salt, and sulfur were virtually unchanged (table 1).

Structure of the Mineral Industry

The Ministry of Commerce and Industry regulated the mining industry according to the Mining Law (Royal Decree No. 27/2003). In March 2008, the Mineral Development of Oman (MDO) was created to encourage investment in the country's mineral industry. MDO was a partnership between the Government's General Directorate of Minerals and private sector entities. The Ministry of Oil and Gas managed the hydrocarbon sector. Petroleum Development Oman L.L.C. (PDO), which was owned by the Government (60% interest), Royal Dutch Shell p.l.c. of the Netherlands (34%), Total S.A. of France (4%), and Partex (Oman) Corp. of Panama (2%), produced more than 80% of the country's crude oil and almost all the supply of natural gas. Royal Decree No. 99/2007 of September 23, 2007, created Oman Refineries and Petrochemicals Co. L.L.C. (ORPC) by merging Oman Refinery Co. L.L.C. and Sohar Refinery Co. L.L.C. as part of a sector restructuring plan. ORPC was owned by the Ministry of Finance (75%) and Oman Oil Co. S.A.O.C. (25%). The Government owned 100% of Oman Oil Co. and had a 51% interest in Oman Liquefied Natural Gas L.L.C. and a 46.84% interest in Qalhat Liquefied Natural Gas S.A.O.C. (Oman Refinery and Petrochemicals L.L.C., 2008).

Takamul Investment Co., which was majority owned by the Government, financed many mineral production projects in the country, including downstream aluminum projects at Metal Park in the Sohar Industrial Area. Takamul was owned by Oman Oil Co. (90% interest), Abu Dhabi Water and Electricity Authority (ADWEA) (5%), and another unnamed investor from the United Arab Emirates (5%).

Commodity Review

Metals

Aluminum.—The construction of the smelter by Sohar Aluminum, which was a joint venture of Oman Oil Co. (40%), ADWEA (40%), and Rio Tinto Alcan (20%), was completed in 2008 at a cost of $2.4 billion. Production at the 350,000-metric-ton-per-year (t/yr)-capacity aluminum smelter began in June, and the first liquid metal delivery to downstream customers was made in August. The plant was expected to operate at full capacity beginning in February 2009. The Sohar Aluminium smelter comprised a single 360-pot AP35G aluminum smelter potline, which used longer-than-normal pots (1.2 kilometers long) at higher electric voltage, thus producing high yields of up to 2,700 kilograms of aluminum per pot per day (Sohar Aluminium, 2008a, b).

[1]Where necessary, values have been converted from Omani rials (RO) to U.S. dollars (US$) at the average rate of RO0.386=US$1.00.

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Several downstream industries were being developed as secondary aluminum industries at the Metal Park in the Sohar Industrial Area. Some of these projects were supported by Takamul. The new downstream aluminum projects were (1) an 80,000-t/yr-capacity rolling mill, which was a joint venture of ADWEA, Gulf Aluminium Rolling Mill Co., and Takamul; (2) a 48,000-t/yr-capacity aluminum rod and electrical conduction manufacturing plant, which was being built by Oman Aluminium Processing LLC; (3) a joint venture of Takamul (49%) and Oman Cable Industry (51%); (4) Future Takamul Metals L.L.C., which was a joint venture of Future Metals Private, Ltd. of India (70%) and Takamul (30%) to produce 30,000 t/yr of deoxidized aluminum rods for the steel industry; (5) a 30,000-t/yr-capacity aluminum billets and extrusions plant that was developed by Europan Takamul, which was a joint venture of Europan S.A. of India and Takamul; and (6) a joint venture of Sazburger Aluminium AG of Australia and Takamul that commenced production at a 30,000-t/yr-capacity plant for aluminum busbars using hot metal from the Sohar Aluminium smelter (Oman Daily Observer, 2009; Zawya, 2009a).

Chromium.—Oman's output of chromite in 2006 was almost double that of 2005; it increased by 450% in 2006, 148% in 2007, and 92% in 2008. Hatton FZE of the United Arab Emirates operated one of the leading chromite quarries in the Somail area, south of Muscat. The chromite ores were of various grades, and the Cr_2O_3 content of concentrate ranged from 30% to 42%. The production capacity was 480,000 t/yr. The other two producers were Gulf Mining and Materials Co. and Oman Chromite Co. S.A.O.G (GMM) (Gulf Mining and Materials Co., 2008; Hatton FZE, 2008).

By yearend 2008, the prices of chromium plummeted and chromium exports to China, which accounted for almost all of Oman's chromite production, were virtually halted because many Chinese steel furnaces that used Omani chrome ore to make ferrochrome were shut down as a result of reduced demand for steel. Subsequently, many of the small-scale chrome mining companies in Oman were in danger of going out of business or stopping their chromite mining operations (Zawya, 2009b).

Copper, Gold, and Silver.—In 2008, the National Mining Co. LLC (NMC) continued to produce copper, gold, and silver at the Hitta and the Shinas pits in the Al Batinah region. The company was exploring for copper, gold, and silver at its Ajib pit, which is located near the Shinas pit along the border with the United Arab Emirates. NMC, which was 100% owned by MB Holding L.L.C. of Australia, was the first private mining company in Oman. The company acquired and refurbished the Lasail copper concentrator from the Government-owned Oman Mining Co., which was closed in 1998, to recover chalcopyrite (copper iron sulfide) and chalcocite (copper sulfide). Production from the Hitta pit was mined out by yearend 2008. Copper production from the Shinas pit proceeded in 2008 and was expected to continue through 2009. NMC was exploring volcanic massive sulfide copper deposits at the Block 1, Block 2, and Ghuzayn concessions (National Mining Co. L.L.C., 2009).

Iron and Steel.—Shadeed Iron and Steel L.L.C., which was a subsidiary of Al-Ghaith Holding PJSC of the United Arab Emirates, moved forward with the construction of the three-phase project to build the first integrated steel plant at Sohar Industrial Port in Oman. The first phase of the project, which started in 2006, included installation of a 1.5-million-metric-ton-per-year (Mt/yr)-capacity direct-reduced iron plant. The second phase included construction of a crude steel plant with the capacity to produce 1.1 Mt/yr of steel billets. The third phase was expected to incorporate a facility in which billets are turned into seamless steel tubes, sections, and bars (Shadeed Iron and Steel L.L.C., 2009).

In May, the Government and Companhia Vale do Rio Doce (CVRD) of Brazil signed an agreement to build two 4.5-Mt/yr-capacity iron ore pellet plants at Sohar Industrial Port. The production capacity could be increased to 18 Mt/yr in the future. Construction of the $1.3 billion project started in December 2008 and production was expected to begin in December 2010. All iron ore for the pellet plant would come from CVRD's iron ore mines in Brazil and would be transported by 400,000-metric-ton (t)-capacity ore carriers. Four carriers, which were being built in China for Oman Shipping Co., would be used by CVRD exclusively for shipping iron ore under a 20-year lease agreement that was signed in 2008. CVRD also planned to establish an iron ore distribution center at Sohar Industrial Port that would be capable of processing 40 Mt/yr of iron ore (Arab Steel, 2008b, 2009; Vale News, 2009).

In December 2008, Gulf United Steel Holding Co. (Foulath) of Bahrain (60%) and JFE Steel Corp. of Japan (40%) formed a joint venture to build a new iron ore pelletizing plant in the Salalah Free Zone with the capacity to produce 7 Mt/yr of pellets. JFE agreed to take one-half of the production (3.5 Mt/yr) for a period of 20 years, and the remaining output would be exported (Arab Steel, 2008a).

Industrial Minerals

Cement.—Oman's cement consumption had been increasing in recent years because of the expansion in the country's infrastructure. Cement consumption in 2008 increased by 60% compared with that of 2005. In March 2008, the Government ended its ban on cement imports to increase the supply of cement in the local market. Although the domestic demand for cement in 2008, which was 4.1 million metric tons (Mt), could have been met by the country's two cement producers, Oman Cement Co. S.A.O.G. and Raysut Cement Co. S.A.O.G., there was a deficit in the supply of cement in Oman because 27% of the national production was exported (Markaz Research, 2008).

Oman Cement, which produced 2.0 Mt/yr of cement in 2008, awarded a $162 million contract to China National Building Material Equipment Corp. to build a third cement production line. The new line, which was expected to double the company's clinker production capacity to 2.4 Mt/yr and to produce 4,000 metric tons per day (t/d), was expected to be completed in 2010. In 2008, Raysut Cement produced 2.1 Mt of cement (Global Cement, 2007, p. 59; Raysut Cement Co. S.A.O.G., 2009, p. 8).

Nitrogen.—Trial production of granular urea began at the Sohar International Urea and Chemical Industries S.A.O.C.'s plant at Sohar Industrial Port. The plant's initial production capacity was 1.2 Mt/yr of granular urea. The project, which comprised a 2,000-t/d-capacity ammonia production plant

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and two granular urea plants with a combined capacity of 3,500 t/d, was built by Mitsubishi Heavy Industries Fertilizer Project Contracting and Construction Co. L.L.C., which was a subsidiary of Mitsubishi Heavy Industries Ltd. of Japan (Suhail Bahwan Group, 2009, p. 16).

Mineral Fuels

Coal.—The Government was evaluating a project to build a coal-fired powerplant at Duqm in the Wusta region to reduce its dependence on natural gas. Electric energy generated by the coal-fired powerplant would be used by Oman Power and Water Co. to supply power to residential and industrial customers. The independent water and powerplant would have 1,000 megawatts of capacity, and was expected to commence production in 2012. The plant would use coal imported from the international market and from local coal deposits. LG International of South Korea signed a memorandum of understanding with Oman Oil Co. and Southern Korea Power Co. to tender the project, which was projected to cost $2 billion (Candappa, 2008; Middle East Economic Digest, 2008).

Natural Gas and Petroleum.—The Government's petroleum strategy was focused on maintaining production at its maturing oilfields at a sustainable level in the mid-term and the long term. Petroleum production in 2008 was 6.8% greater than in 2007. The increase in 2008, which was attributed to the application of enhanced crude oil recovery methods PDO, reversed the downturn in production that began in 2001. The Government implemented plans to increase crude oil output to 830,000 barrels per day (bbl/d) in 2009 from 757,000 bbl/d in 2008 and 710,000 bbl/d in 2007 but that was still less than the peak output of 956,000 bbl/d achieved in 2001. In 2008, PDO announced two oilfield discoveries at Malaan West and Taliah 1 in its Lekhwair Cluster, which is located in northwestern Oman (Alexander's Gas & Oil Connections, 2009; Petroleum Development Oman L.L.C., 2009; Petroleum Economist, 2009).

Production of natural gas was slightly less in 2008 than in 2007, which subsequently caused a 5.8% decrease in Oman's liquefied natural gas exports. In 2008, PDO commenced production from the Haban cluster fields and completed gas compression projects at the Barik, the Saih Nihayda, and the Yibal clusters (Petroleum Development Oman L.L.C., 2009).

Petroleum refining had steadily increased in the past 5 years at the country's two refineries at Mina Al-Fahal and Sohar. The Government's plan to build a third refinery at Al-Duqm was still being finalized. The new refinery, which was expected to be completed in 2012, would have a production capacity of between 250,000 and 300,000 bbl/d and would include a petrochemical complex (Petroleum Economist, 2008; Alexander Gas & Oil Connections, 2009).

In August 2007, the Government signed a contract with Engineers India Ltd. for the front end engineering work to build the country's first asphalt plant at the Sohar Refinery Complex. The $80 million asphalt plant was expected to commence production in the first quarter of 2010 and would produce three grades of bitumen (Zawya, 2007).

Outlook

Oman, which is a relatively new player in the steel industry, is set to become a significant regional iron and steel producer as the Middle East demand for steel is expected to rise. The choice of Oman as the regional headquarters for CVRD will make Oman the company's hub for its growing operations in the Middle East. With the commencement of production at the Sohar Aluminium smelter, Oman has joined other aluminum producers in the Gulf and embarked on establishing additional downstream secondary aluminum production plants at the Metal Park in the Sohar Industrial Area. To speed up the slow pace at which Oman's vast and diversified mineral resources are currently being developed, Takamul is expected to establish Oman's Mineral City, which is intended to serve as the focal point for future mineral industry activity. By 2012, Oman is likely to have its first coal-fired powerplant at Duqm and the first bitumen refinery in the Gulf in the Sohar Port area.

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TABLE 1

OMAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Aluminum		--	--	--	--	49,000
Chromium, gross weight		26,600 r	50,400 r	276,300 r	407,822 r	784,082
Copper, metal:						
Ore, metal content		--	--	-- r	1,000 r	1,000
Smelter output, metal content		16,000	25,000	20,710 r	14,000 r	12,000
Refined metal		15,090	24,543	20,710 r	13,940 r	11,906
Gold	kilograms	211	384	201 r	125 r	43
Iron and steel:						
Crude steel[e]		84,000	84,000	84,000	84,000	84,000
Laterite		NA	1,740,416	271,200	295,012	301,117
Silver	kilograms	89	122	236 r	51 r	9
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	2,621	2,686	3,611	3,880	4,000
Clay		NA	46,104	92,500	76,747	183,325
Gypsum		103,000	133,100	254,000 r	183,200 r	179,800
Limestone		NA	2,502,794	2,732,600	3,098,300	2,391,500
Marble		163,800	220,900	270,800	311,861	457,146
Quartz		NA	200,897	181,500	211,900	176,500
Salt		12,400	10,900	26,300 r	10,452 r	10,444
Sand and gravel:						
Sand	thousand metric tons	NA	17,760	24,900	22,029	194,860
Gravel	do.	23,000 e	24,000 e	51,715	39,438	49,434
Total	do.	23,000 e	24,000 e	76,615 r	61,467 r	244,294
Sulfur[e]		30,000	30,000	40,000	50,000	50,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	24,150	23,998	29,783	30,320	30,265
Dry	do.	17,000 e	17,390	23,163 r	24,128 r	24,037
Natural gas liquids[e]	thousand 42-gallon barrels	6,000	6,000	7,000	7,100	7,100
Nitrogen:						
N content of ammonia		--	620,000	1,000,000	1,000,000	1,000,000
N content of urea		--	320,000	830,000	830,000	830,000
Petroleum:						
Crude and condensate	thousand 42-gallon barrels	285,385	282,616	269,242	259,293	276,971
Refinery products:						
Liquefied petroleum gas	do.	473	580	630	915	915
Gasoline	do.	5,215	5,436	5,078	3,908	6,514
Jet fuel and kerosene	do.	1,407	1,770	2,339	2,160	3,037
Distillate fuel oil	do.	6,442	7,089	6,750	2,849	8,132
Residual fuel oil	do.	14,247	15,445	14,947	13,177	18,561
Other	do.	1,162	1,253	1,283	344	28
Total	do.	28,946	31,573	31,027	23,353	37,187

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available. -- Zero.

[1]Table includes data available through March 31, 2010.

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TABLE 2
OMAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Sohar Aluminium Co. [Oman Oil Co., 40%; Abu Dhabi Water and Electricity Authority (ADWEA), 40%; Rio Tinto Alcan, 20%]	Smelter at Sohar	360,000
Cement		Oman Cement Co. S.A.O.G. (Ministry of Commerce and Industry, 30.4%)	Kilns and mills at Rusayl	2,500,000
Do.		Raysut Cement Co. S.A.O.G.	Kilns and mills at Salalah	2,700,000
Chromite		Hatton FZE	Mines south of Muscat	480,000
Do.		Gulf Mining and Materials Co.	Wadi Mahram area	200,000
Do.		Oman Chromite Co. S.A.O.G. (Ministry of Commerce and Industry, 15%)	Mines near Sohar	200,000
Clays		NA	NA	185
Copper:				
Ore		National Mining Co. L.L.C. (MB Holding Co. L.L.C.)	Open pit mines at Ajib, Hitta, and Shinas	40,000
Refined metal		Oman Mining Co. L.L.C.	Lasail, near Sohar	14,000
Gold:				
Ore		National Mining Co. L.L.C. (MB Holding Co. L.L.C.)	Open pit mines at Ajib and Shinas	NA
Metal	kilograms	National Mining Co. L.L.C.	Lasail, near Sohar	100
Gypsum		Companies that quarried gysum included Cement Gypsum Products Co. S.A.O.G., Global Mining Co. L.L.C., and Gulf Mining and Materials Co.	Buraimi and Thumriat	180
Iron and steel:				
Iron ore (laterite)		Gulf Mining and Materials Co.	Barka	300,000
Crude steel		Modern Steel Mills L..L.C. (Oman International Development and Industrial Co. S.A.O.G., Assarain Group of Companies, Dharamsey Group, and others)	Rusayl	84,000
Rolled steel products (rebar)		Sharq Sohar Steel Rolling Mills L.L.C.	Sohar	250,000
Do.		Hadid Majan L.L.C.	Bait Al Falaj	100,000
Rolled steel products (tubes)		Al Jazeera Tube Mills Co. S.A.O.G.	Sohar	300,000
Limestone		Oman Cement Co. S.A.O.G. (Ministry of Commerce and Industry, 30.4%)	Rusayl	2,400,000
Marble		Companies that quarried marble included Al Ajmi Marble Co., Al Madinah Marble Co., Al Nasser Marble Co., Al Rushaidi Marble Co., Al Shanfri Marble Co., Al Zarabi Marble Co., Gulf Mining Materials Co., International Marble, and Omani Marble Co.	Quarries primarily located in the Wilayat of Ibri and Buraimi area	450,000
Natural gas	million cubic meters	Petroleum Development Oman L.L.C. [Government, 60%; Royal Dutch Shell p.l.c., 34%; Total S.A., 4%; Partex (Oman) Corp., 2%]	Gasfields and oilfields with associated natural gas in the Kauther/Yibal, the Saih Niyahda, and the Saih Rawl clusters	27,000
Natural gas, liquefied	do.	Oman Liquefied Natural Gas L.L.C. [Government, 51%; Royal Shell Gas B.V., 30%; Total S.A., 5.54%; Korea LNG, 5%; Mitsubishi Corp., 2.77%; Mitsui E&P Middle East B.V., 2.77%; Partex (Oman) Corp., 2%; Itochu Corp., 0.92%]	Two trains at Qalhat	6,600,000
Do.	do.	Qalhat Liquefied Natural Gas S.A.O.C. (Government, 46.84%; Oman Liquefied Natural Gas L.L.C., 36.8%; Union Fenosa S.A., 7.36%; Mistubishi Corp., 3%; Oskas Gas, 3%; Itochu Corp., 3%)	One train at Qalhat	3,300,000
Petroleum:				
Crude	barrels per day	Petroleum Development Oman L.L.C. (PDO) [Government, 60%; Royal Dutch Shell p.l.c., 34%; Total S.A., 4%; Partex (Oman) Corp., 2%]	About 100 oilfields in the Bahja, the Fahud, the Harweel, the Lekhwair, the Marmul, the Nimr, the Qarn Alam, and the Yibal clusters	900,000

See footnotes at end of table.

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TABLE 2—Continued
OMAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:				
Crude—Continued	barrels per day	Oxy Oman, Inc. (Occidental Petroleum Corp., 65%, and Mitsui E&P Middle East B.V., 35%)	Blocks 9 and 27, includes the Safah and Al Sunienah fields	55,000
Do.	do.	Daleel Petroleum Co. L.L.C. (Mazoon Petrogas S.A.O.C., 50%, and Mazoon Petrogas B.V.I., 50%)	Block 5, includes the Bushra, the Daleel, the Mezoon, and the Shadi fields	16,000
Do.	do.	Occidental Mukhaizna, L.L.C. [Occidental Petroleum Corp., 45%; Oman Oil Corp. S.A.O.C., 20%; Shell Oman Trading Co. Ltd., 17%; Liwa Energy Ltd., 15%; Total Exploration and Production Oman, 2%; Partex (Oman) Corp., 1%]	Block 53, Mukhaizna field	8,500
Do.	do.	Partnership of Indago Oman Ltd., 40% (operator); LG International Corp., 50%; Eagle Energy (Oman) Ltd., 10%	Block 8, Bukha field	1,100
Refined	million barrels	Oman Refineries and Petrochemicals Co. L.L.C. (ORPC) (Ministry of Finance, 75%, and Oman Oil Co. S.A.O.C., 25%)	Refinery at Sohar	41
Do.	do.	do.	Refinery at Mina Al-Fahal	37
Quartz		Gulf Stone Co. S.A.O.G.	Sohar	180
Salt, crude, industrial		Modern Salt Co. L.L.C.	Wilayat of Ibri	10
Silver	kilograms	Oman Mining Co. L.L.C.	Sohar and Yankul	50

Do., do. Ditto. NA Not available.

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The Mineral Industry of Qatar

By Mowafa Taib

In 2008, the State of Qatar was a significant producer of ammonia, crude oil, helium, liquefied natural gas (LNG), and urea. Qatar was the world's leading exporter of LNG in 2008 and the second ranked producer of helium after the United States, accounting for 7.4% of the world's total supply of helium. Qatar was the eighth ranked producer of natural gas and accounted for 2.5% of the world's output. Qatar contributed 1% of the world's crude oil production and 1.3% of the world's ammonia production. The country's gas reserves at the end of 2008 were estimated to be 25 trillion cubic meters, which composed 14% of the world's reserves, and were smaller in volume only than those of, in order of reserve volume, Russia and Iran. As of yearend 2008, Qatar's crude oil reserves were 15.2 billion barrels, or 1.3% of the world's total reserves. Qatar produced crude steel, refined petroleum products, semimanufactured billets and bars, and urea fertilizer (Apodaca, 2009; BP p.l.c., 2009, p. 22, 24; Organization of Arab Petroleum Exporting Countries, 2009, p. 10, 13, 20; Pacheco, 2009).

Minerals in the National Economy

Qatar's economy continued its robust growth in 2008 and achieved an annual growth rate of 40.9% at current prices compared with 25.5% in 2007. The economy maintained an average growth of 33.7% per year in the 5-year period of 2004–08. Hydrocarbons accounted for about 61% of the gross domestic product (GDP) at current prices. In 2008, the hydrocarbon sector increased in value by 51.6% and the nonhydrocarbon sector, which accounted for 39% of the GDP, increased by 26.9% compared with the value in 2007. The manufacturing sector, which included the production of cement, fertilizer, refined petroleum products, and steel, grew by 32.4% in 2008 and accounted for about 7% of the GDP (Qatar National Bank S.A.Q., 2009, p. 10).

In 2008, Qatar's exports of goods were valued at $56.6 billion[1] compared with $42.0 billion in 2007. Natural gas liquids exports accounted for 41% of total exports; crude oil exports, 39%; and other exports, which included ammonia, helium, methanol, steel, sulfur, and urea, 19%. The increase in the value of exports was attributable to the increased volume of crude oil and natural gas exports and to higher world crude oil prices, which, for Qatar, averaged $95.20 per barrel in 2008 compared with $70.00 per barrel in 2007. In 2008, Qatar's total natural gas exports were about 56.7 billion cubic meters compared with 45.6 billion cubic meters in 2007. LNG exports were about 33.8 billion cubic meters in 2008 compared with 30.4 billion cubic meters in 2007, which was an increase of about 11%. The major importers of Qatari LNG were the Republic of Korea, which received about 28%; Japan, 23%; and Spain, 9%. Urea fertilizer exports accounted for 3% of total exports; iron and steel products, 1%; and other mineral commodities, such as ammonia and helium, 0.6% (Qatar Central Bank, 2009, p. 10; Qatar National Bank S.A.Q., 2009, p. 10, 34).

[1]Where necessary, 2008 values have been converted from Qatari riyals (QR) to U.S. dollars (US$) at the rate of QR3.640 = US$1.00.

Production

There were notable increases in the production of mineral commodities in 2008 compared with production levels in 2007. These increases included helium, 76%; cement, 46%; direct-reduced iron (DRI), 26%; crude steel and dry gas, 22% each; liquefied natural gas, 11%; methanol, 9%; sulfur, 4%; and crude oil, 2% (table 1).

Structure of the Mineral Industry

State-owned Qatar Petroleum was the Government agency responsible for managing the country's gas, fertilizer, oil, and petrochemical industries and petroleum refineries through its subsidiaries and joint ventures. Qatar Petroleum produced LNG from the North Field as part of several production-sharing agreements with international oil companies (IOCs) to operate Qatargas and Rasgas projects. These projects were known as Qatar Liquefied Natural Gas Co. Ltd. 1; Qatar Liquefied Natural Gas Co. Ltd. 2; Qatar Liquefied Natural Gas Co. Ltd. 3; Qatar Liquefied Natural Gas Co. Ltd. 4; Ras Laffan Liquefied Natural Gas Co. Ltd.; Ras Laffan Liquefied Natural Gas Co. Ltd. II; and Ras Laffan Liquefied Natural Gas Co. Ltd. III. Qatar Petroleum held a majority interest in Industries Qatar Q.S.C., which in turn held a majority interest in Qatar Fertilizer Co. S.A.Q (Qafco), Qatar Fuel Additives Co. Ltd. Q.S.C (Qafac), Qatar Petrochemical Co. (Qapco), and Qatar Steel Co. Q.S.C. (table 2). Qatar Petroleum International was a subsidiary of Qatar Petroleum, which administered Qatar Petroleum's investments in LNG regasification terminals in Italy, the United Kingdom, and the United States (Qatar Petroleum, 2009, p. 11).

Commodity Review

Metals

Aluminum.—Qatar Aluminium Ltd. (Qatalum) moved forward with the construction of a $5.6 billion 585,000-metric-ton-per-year (t/yr)-capacity smelter, which began in 2007 and continued throughout 2008. First commissioning was expected by yearend 2009, and full production was scheduled for 2010. Qatalum was a 50-50 joint venture of Qatar Petroleum and Norsk Hydro A.S.A of Norway. Qatar Petroleum agreed to provide the gas supply and plant site and Norsk Hydro would contribute its technology, metal marketing experience, and project management expertise. The plant, which would have its own 1,370-megawatt powerplant, had a capacity expansion option to 1.2 million metric tons per year (Mt/yr) included in its initial design (Norsk Hydro ASA, 2008).

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Iron and Steel.—Qatar Steel was the sole producer of steel in Qatar in 2008. In addition to its production and processing facility at Mesaieed, Qatar Steel operated a steel bar and coil processing plant in Dubai, United Arab Emirates. The company had substantial equity interest in Gulf Industrial Investment Co. and United Stainless Steel Co. (both of Bahrain), as well as Qatar Metals Coating Co. W.L.L. In 2008, Qatar Steel became the fourth ranked producer of steel in the Middle East as several of its expansion projects were completed and the new units were put into operation. Qatar Steel produced 1.6 million metric tons (Mt) of hot-briquetted iron (HBI) and DRI from its two-module plant, 1.4 Mt of steel billets, 1.2 Mt of reinforced steel bars, and 102,000 metric tons (t) of coils that were produced in the Qatar Steel facility in Dubai. The company's total sales in 2008 were about 1.9 Mt in volume, 87% of which was bars; 9%, DRI and HBI; and 4%, billets. The volume of exports included 81,121 t of DRI, 149,666 t of HBI, 54,000 t of crude iron oxide powder, and 40,000 t of processed iron ore powder.

Qatar Steel moved forward with its expansion plan to increase its crude steel production capacity to 4 Mt/yr in 5 years. In 2008, the company conducted feasibility studies for growth plans, canceled its 15% stake in the Guleb El-Auj mining project in Mauritania because of a disagreement with Sphere Investments Ltd. of Australia concerning ownership interest, and continued its search for potential joint-venture projects with major iron ore suppliers to guarantee continuous feed of iron ore from production mines around the world to processing plants in Qatar (Qatar Steel Co., Q.S.C., 2009, p. 10-15).

Industrial Minerals

Cement.—The downturn of the global economy appeared to have little or no effect on Qatar's cement market as the building and construction sector grew by 24% in 2008. In 2008, the volume of cement production and sales in Qatar was more than 5 Mt, which was a 24% increase compared with that of 2007, which in turn was an increase of 23% compared with that of 2006. Qatar National Cement moved forward with its expansion plan to add a new 1.5-Mt/yr-capacity production line, which was expected to be completed in early 2009 (Gulf Times, 2009).

Nitrogen.—In April 2008, Qafco officially started its fifth phase (Qafco V) expansion project at the Mesaieed complex. The Qafco V project was expected to be completed in 2010, and it would increase ammonia output to 3.8 Mt/yr and urea output to 4.3 Mt/yr from 2.3 Mt/yr and 3.0 Mt/yr, respectively. Qafco had plans for a sixth phase expansion that would produce 3.1 Mt/yr of granular urea. The Qafco VI expansion was expected to be completed by 2015. In 2008, Qatar's ammonia exports of 451,000 t were received by India (46%), Jordan (29%), the United States (8%), China (7%), and others (4%). The destinations of Qatar's exports of urea, which amounted to 3.1 Mt in 2008, were the United States (17%), Thailand (15%), India (12%), South Africa (10%), and others (12%) (Qatar Fertilizer Co. S.A.Q., 2008, p. 10, 14; Qatar National Bank S.A.Q., 2009, p. 25).

Mineral Fuels and Related Materials

Helium.—Most of Qatar's helium resources were located in the offshore North Field. Qatar accounted for about 20% of the world's helium resources in 2008. Qatargas increased helium output by continuing to improve of the helium recovery unit at Ras Laffan, which started production in 2005 (Pacheco, 2009).

Natural Gas.—In November 2008, Qatar was chosen to host the Forum of Gas Exporting Countries, which includes 12 of the world's largest gas-exporting countries (Rigzone.com, 2008). The discovery of the North Field in 1971, which continues to be the largest nonassociated gasfield in the world, was a major transformation point for Qatar. North Field has an area of about 6,000 square kilometers and holds gas reserves that are equivalent to 162 billion barrels (Gbbl) of oil, or about 14% of the world's gas reserves, and could support gas production for 200 years at current rates of extraction. Qatar Petroleum, through its subsidiaries and joint-venture partners, had been undertaking several gas production, transportation, and distribution projects, including two principle LNG projects—Qatargas and Rasgas. The Qatargas and Rasgas ventures signed several sales and purchase agreements with companies in Belgium, India, Italy, Japan, the Republic of Korea, Spain, the United Kingdom, and the United States to export 85.5 billion cubic meters per year of LNG by the year 2012 using dedicated LNG tankers owned by Qatar Gas Transport Co. (Nakilat). Nakilat, which was established in 2005, had 28 LNG tankers and 3 liquefied petroleum gas (LPG) carriers by yearend 2008 (Qatar National Bank S.A.Q., 2009, p. 18-22; Organization of Arab Petroleum Exporting Countries, 2009, p. 77).

Dolphin Energy Ltd. started natural gas production and distribution through a 400-kilometer (km) undersea pipeline from the North Field to the receiving terminals of Taweelah in Abu Dhabi and Jebal Ali in Dubai, United Arab Emirates, in 2007. The company achieved the targeted production rate of 56.6 million cubic meters per day of natural gas in February 2008. Dolphin awarded a $212 million engineering and production contract to Qatar Engineering and Construction Co. to double the volume of the low-sulfur condensate storage facility located in Ras Laffan (Dolphin Energy Ltd., 2008).

Gas-to-liquids (GTL) projects, which aim to make natural gas a portable global commodity, continued to receive the Government's support. In November 2008, Oryx GTL, which was a joint venture between Qatar Petroleum and Sasol Ltd. of South Africa, was established to convert natural gas to diesel, naphtha, and LPG. Oryx GTL announced that it would achieve the 34,000-barrel-per-day (bbl/d) production target within 1 year. The company began production in 2007 but suffered technical difficulties that caused an interruption of production at the beginning of 2008. The Pearl GTL project, which was the world's largest GTL plant in terms of output, was a joint-development project of Qatar Petroleum and Royal Dutch Shell plc to use the Shell Middle Distillate Synthesis technology. Construction work at Pearl GTL continued at a fast pace in 2008. The cost of the project, which employed more than 40,000 workers at Ras Laffan, exceeded $15 billion, or more than 250% of the $6 billion initial cost estimate of 2004. The production capacity for GTL, including low-sulfur diesel and kerosene,

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base oil, naphtha, and paraffin, was expected to be 70,000-bbl/d in the first phase in 2010 (Petroleum Economist, 2008; Royal Dutch Shell plc, 2009).

The Barzan gas project, which was a joint venture of Qatar Petroleum (90% interest) and Exxon Mobil Corp. of the United States (10%), was launched in 2007 to produce about 40 million cubic meters per day of gas from the North Field for domestic use. Construction of the project in 2008 was delayed because of the soaring construction costs.

Petroleum.—The Government's policy regarding crude oil was to enhance the country's reserves and discover new reserves. Based on the production levels in the past 5 years, which averaged 801,000 bbl/d, Qatar expected that its crude oil reserves would last 89 years. Thus, Qatar Petroleum planned to increase oil production to 1,055,000 bbl/d by yearend 2010 (Qatar National Bank S.A.Q, 2009, p. 14).

In 2008, Qatar Petroleum produced 41% of Qatar's total oil production by operating the onshore Dukhan oilfield and the Bul Hanine and the Maydan Mahzam offshore fields; the remaining 59% was produced by the IOCs. Qatar Petroleum had signed several exploration, development, and production-sharing agreements with IOCs, including with Occidental Petroleum Corp. of the United States, to increase production from the Idd Al Shargi offshore field. Occidental also operated the Al Rayyan offshore field. Maersk Oil of Denmark and Qatar Petroleum worked jointly on developing the Block 5 offshore field, which is located northeast of the Al Shaheen field. The field produced 330,000 bbl/d and was the highest yielding oilfield in Qatar in 2008. Total Fina Elf Qatar S.A. operated the Al Khalij field (the Block 6 offshore field) under a development and production-sharing agreement with Qatar Petroleum. Qatar Petroleum Development Co Ltd. of Japan operated the Al Karkara offshore field. In 2008, Wintershall A.G. of Germany signed an exploration and production-sharing agreement with Qatar Petroleum to explore for oil in Block 14 and Block 4 North (the Khuff), and Occidental Petroleum was awarded Block 4 (Qatar National Bank S.A.Q., 2009, p. 15-16; Qatar Petroleum, 2009, p. 11).

Construction of the new Ras Laffan Condensate Refinery continued in 2008, and the project was expected to be completed during the third quarter of 2009. The 146,000-bbl/d-capacity refinery was expected to cost $800 million. Laffan Refinery Co. Ltd. was responsible for the operation of the new refinery. The Laffan refinery was owned 51% by Qatar Petroleum; 10% each by Cosmo Oil Co. of Japan, ExxonMobil, Idemitsu Kosan Co. Ltd. of Japan and Total; and 4.5% each by Japanese companies Mitsui and Co. Ltd. and Marubeni Corp. In 2008, Qatar's refining capacity at the Mesaieed Industrial City was 200,000 bbl/d. Other projects, such as the Al Shaheen refinery and the Mesaieed aromatic plant, were postponed to take advantage of the reduction of construction prices caused by the global economic downturn (U.S. Energy Information Administration, 2009; Zawya, 2009).

Outlook

The gas and crude oil resources of Qatar are estimated to support 200 years of planned gas production and 89 years of crude oil production, and the country is striving to increase its exports of LNG to 85.5 billion cubic meters in 2012. LNG exports in 2009 are expected to increase to 48.9 billion cubic meters in 2009, up from 33.8 billion cubic meters in 2008. Output of the fertilizer and steel industries is likely to increase because of expansion projects currently under construction. The Government is planning to invest more than $40 billion in the development of crude oil, GTL, natural gas, petrochemical, and refining projects and in the construction of industrial zones during the 5-year period of 2009–13. Although several mineral industry projects in Qatar had been cancelled or delayed because of skyrocketing costs for construction, engineering services, labor, and materials, all natural gas projects that had been under construction were either completed or were in the process of being completed, including the building of LNG tankers and LNG terminals in Italy, the United Kingdom, and the United States.

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TABLE 1
QATAR: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Iron and steel:						
Direct-reduced iron		830	815	877	1,296	1,638
Steel, crude		1,089	1,057	1,003 r	1,175	1,434
Semimanufactures:						
Billet, cast		1,050	1,020	1,013	1,147	1,405
Bars, rolled		782	791	730	958	1,150
INDUSTRIAL MINERALS						
Cement, hydraulic[e]		1,400	1,400	1,568 [3]	2,400 r, [3]	3,500
Gypsum		NA	NA	NA	NA	135
Nitrogen:						
N content of ammonia		1,428	1,754	1,784	1,800	1,797
N content of urea		1,040	1,388	1,356	1,381	1,396
Stone, limestone[e]		1,000	1,000	1,100	1,100	1,100
Sulfur[e]		360 r	360 r	400 r	500 r	600
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	48,470 r	57,600 r	64,200 r	77,200 r	90,887
Dry	do.	39,170 r	45,800 r	50,700 r	63,200 r	76,981
Helium	thousand cubic meters	--	200	4,400	7,100 r	12,500
Methanol		840	900	903	884	960
Natural gas liquids	thousand 42-gallon barrels	65,700 r	76,650 r	73,000 r	76,650 r	80,300
Petroleum:						
Crude	do.	277,000 r	284,000 r	296,000 r	299,000	305,500
Refinery products:						
Liquified petroleum gas	42-gallon barrels	1,387 r	26,024 r	40,077 r	43,508 r	47,888
Gasoline	do.	14,673 r	14,235 r	14,856 r	17,702 r	17,228
Kerosene and jet fuel	do.	7,592 r	7,774 r	9,198 r	10,877 r	9,417
Distillate fuel oil	do.	7,300 r	7,410 r	7,957 r	9,088 r	10,877
Residual fuel oil	do.	4,636 r	2,518 r	5,037 r	3,468 r	2,920
Other	do.	7,044 r	7,995 r	7,445 r	9,271 r	8,103
Total	do.	42,632 r	65,956 r	84,570 r	93,914 r	96,433

[e]Estimated, estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through October 31, 2009.

[2]In addition to the commodities listed, clays, dolomite, gypsum, lime, sand and gravel, and shale are produced, but available information is inadequate to make estimates of output.

[3]Reported figure.

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TABLE 2
QATAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Qatar Aluminium Ltd. (Qatalum) (Qatar Petroleum, 50%, and Hydro ASA, 50%)	Mesaieed	585 [1]
Cement:				
Portland		Qatar National Cement Co. (Government, 43%, and private Qatari investors, 57%)	Kilns and mills at Umm Bab	2,500
Do.		Al-Jabor Cement Industries Co.	Clinker grinding mill at Mesaieed	165
White		Qatari Saudi Company for Industrial Transformation	do.	165
Gypsum		Qatari Saudi Company for Gypsum (Qatar Industrial Manufacturing Co., 33.375%; Qatar National Cement Co., 33.250%; National Gypsum Co., 33.375%)	Salwa Industrial Area	135
Helium		Joint venture of Qatar Liquefied Gas Co. Ltd., Ras Laffan Liquefied Natural Gas Co. Ltd., and Ras Laffan Liquefied Natural Gas Co. Ltd. (II)	Ras Laffan	12,500
Iron and steel:				
Iron, direct reduced		Qatar Steel Co. Q.S.C. (Industries Qatar Q.S.C., 100%)	Mesaieed	2,400
Steel, crude		do.	Plant at Mesaieed	1,470
Steel, rolled		do.	Rolling mill at Mesaieed	1,440
Lime		Qatar National Cement Co. (Government, 43%, and private Qatari investors, 57%)	Kilns at Umm Bab	28
Methanol		Qatar Fuel Additives Co. Ltd. Q.S.C. (Qafac) (Industries Qatar Q.S.C., 50%; OPIC Netherlands Antilles N.V., 20%; Lee Chang Yung Chemical Industry Corp., 15%; International Octane Ltd., 15%)	Mesaieed	913
Natural gas:				
Extracted	billion cubic meters	Qatar Liquefied Gas Co. Ltd. (Qatar Petroleum, 65%; Total S.A., 20%; ExxonMobil Qatargas Inc., 10%; Mitsui & Co., Ltd., 2.5%; Marubeni Corp., 2.5%)	North Field, offshore	20
Do.	do.	Ras Laffan Liquefied Natural Gas Co. Ltd. (I) (Qatar Petroleum, 63%; ExxonMobil Rasgas, Inc., 25%; Korea Gas Corp., 5%; Itochu Corp., 4%; LNG Japan Corp., 3%)	do.	11
Do.	do.	Qatar Petroleum (Government, 100%)	do.	1
Liquefied		Qatar Liquefied Gas Co. Ltd. 1 (Qatar Petroleum, 65%; Total S.A., 10%; ExxonMobil Qatargas Inc., 10%; Mitsui & Co., Ltd., 7.5%; Marubeni Corp., 7.5%)	Three trains at Ras Laffan	10,200
Do.		Qatar Liquefied Gas Co. Ltd. 2 (Qatar Petroleum, 70%, and ExxonMobil Qatargas Inc., 30%)	Train 4 at Ras Laffan	7,500 [1]
Do.		Qatar Liquefied Gas Co. Ltd. 3 (Qatar Petroleum, 68.5%; ConocoPhilips, 30%; Mitsui and Co., 1.5%)	Train 5 at Ras Laffan	7,500 [1]
Do.		Qatar Liquefied Gas Co. Ltd. 4 (Qatar Petroleum, 70%, and Royal Dutch Shell plc, 30%)	Train 7 at Ras Laffan	7,800
Do.		Ras Laffan Liquefied Natural Gas Co. Ltd. (I) (Qatar Petroleum, 63%; ExxonMobil Rasgas, Inc., 25%; Korea Gas Corp., 5%; Itochu Corp., 4%; LNG Japan Corp., 3%)	Two trains at Ras Laffan	6,600
Do.		Ras Laffan Liquefied Natural Gas Co. Ltd. (II) (Qatar Petroleum, 70%, and ExxonMobil Rasgas, Inc., 30%)	Trains 3, 4, and 5 at Ras Laffan	14,300
Do.		Ras Laffan Liquefied Natural Gas Co. Ltd. 3 (Qatar Petroleum, 70%, and ExxonMobil Rasgas, Inc., 30%)	Trains 6 and 7 at Ras Laffan	15,600 [1]
Nitrogen:				
Ammonia		Qatar Fertilizer Co. S.A.Q. (Qafco) (Industries Qatar Q.S.C., 75%; Yara Nederland BV, 15%; Fertilizer Holdings AS, 10%)	QAFCO 1, Mesaieed	420
Do.		do.	QAFCO 2, Mesaieed	440
Do.		do.	QAFCO 3, Mesaieed	650
Do.		do.	QAFCO 4, Mesaieed	740

See footnotes at end of table.

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TABLE 2—Continued
QATAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nitrogen—Continued:				
Urea		Qatar Fertilizer Co. S.A.Q. (Qafco) (Industries Qatar Q.S.C., 75%; Yara Nederland BV, 15%; Fertilizer Holdings AS, 10%)	QAFCO 1, Mesaieed	470
Do.		do.	QAFCO 2, Mesaieed	530
Do.		do.	QAFCO 3, Mesaieed	890
Do.		do.	QAFCO 4, Mesaieed	1,300
Petroleum:				
Crude	42-gallon barrels	Maersk Oil Qatar A.S., operator[2]	Al Shaheen field, offshore	330,000
Do.	do.	Qatar Petroleum (Government, 100%)	Dukhan field, onshore	256,000
Do.	do.	Occidental Petroleum of Qatar Ltd., operator[2]	Idd Al Sharqi, North Dome and South Dome, offshore	11,3000
Do.	do.	Qatar Petroleum (Government, 100%)	Bul Hanine field, offshore	37,000
Do.	do.	Total S.A., operator[2]	Al Khaleej, offshore	37,500
Do.	do.	do.	Maydan Mahzam Field, offshore	36,000
Do.	do.	Bunduq Co., Ltd. operator[2] (BP Exploration, 33.3%; Total S.A., 33.3%; United Petroleum Development Co., 33.3%)	El Bunduq[3]	7,300
Do.	do.	Anadarko Petroleum Corp., 92.5%, operator[2]	Al Rayyan, offshore	8,600
Do.	do.	Qatar Petroleum Development Co. operator[2] (Cosmo Oil Co., Nissho Iwai Corp., United Petroleum Development Co.)	Al Karkara and A Structure	6,200
Refined	do.	Oryx GTL Ltd. (Qatar Petroleum, 51%, and Sasol Ltd., 49%)	Ras Laffan	12,400
Do.	do.	The Laffan Refinery Co. Ltd. (Qatar Petroleum, 51%; Cosmo Oil Co., 10%; Exxon Mobil Corp.; 10%; Idemitsu Kosan Co. Ltd., 10%; Mitsui and Co., 4.5%; Marubeni Corp. 4.5%)	do.	146,000 [1]
Do.	do.	Qatar Petroleum (Government, 100%)	Mesaieed	200,000
Sulfur		Ras Laffan Liquefied Natural Gas Co. Ltd.	Ras Laffan	110
Do.		Qatar Petroleum (Government, 100%)	Mesaieed	95
Do.		Qatar Petrochemical Co. Ltd.	Umm Said	70
Do.		Qatar Liquefied Gas Co. Ltd.	Ras Laffan	66

Do., do. Ditto.

[1]Under construction.

[2]Operated under a development and production-sharing agreement with Qatar Petroleum.

[3]El Bunduq field is located on the border between Qatar and the United Arab Emirates. Royalties are shared by the Governments.

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The Mineral Industry of Saudi Arabia

By Philip M. Mobbs

The Kingdom of Saudi Arabia ranked first in the world with about 21% of the total proved oil reserves and maintained its position as the leading producer of petroleum (which included condensate, crude oil, and natural gas liquids) in the world. The country ranked ninth in the world in terms of petroleum refining capacity and was the 32d ranked steel producer. A variety of industrial minerals and metals also were produced in Saudi Arabia (table 1; BP p.l.c., 2009, p. 6, 9; U.S. Energy Information Administration, 2009; World Steel Association, 2009).

All mineral deposits are the exclusive property of the state. The Supreme Council for Petroleum and Mineral Affairs defines and approves national hydrocarbon policies and strategies. The Ministry of Petroleum and Mineral Resources implements general policy related to minerals, natural gas, and oil. Mining is regulated by Royal Decree No. M/47 (the Mineral Investment Law) of 20 Sha'ban 1425 (October 4, 2004).

Minerals in the National Economy

Saudi Arabia's economy remained strongly linked to hydrocarbon production, which accounted for more than 60% of the nominal gross domestic product in 2008. The hydrocarbon sector overall accounted for nearly 90% of national merchandise exports; any notable change in Saudi Arabian crude oil production or the international oil price significantly affects the country's economy. Petroleum revenues (which increased by nearly 75% in 2008 compared with those in 2007 in terms of riyals[1]) accounted for 89% of Government income. Development projects funded from the Government's budget surplus from previous years included education projects (32.3% of total appropriations), water and sewage projects (20.7%), municipal services (13.2%), road projects (6.3%), water desalination projects (3.9%), and 2,164 projects in the industrial sector that included energy-intensive mineral-related heavy industries and petrochemicals (3.2%) (Saudi Arabian Monetary Agency, 2009, p. 135, 137, 144, 318).

In 2008, crude oil export volumes increased by 5.2% to 2.67 billion barrels compared with 2.54 billion barrels in 2007. The preliminary value of crude oil exports was $247 billion, which was a 38.5% increase compared with that of 2007. The increase in the value of crude oil exports was attributable to increases in the production volume and the average price of crude oil. Saudi Arabian oil prices fluctuated significantly in 2008, rising to an average of $131.22 per barrel in July before dropping to $36.50 per barrel in December. In 2008, the average price of the Arabian Light standard-type crude oil increased to $94.77 per barrel compared with $68.74 per barrel in 2007 (which was almost a 40% increase). Arabian Medium increased to an average of $91.77 per barrel compared with $65.03 per barrel in 2007, and Arabian Heavy increased to an average of $87.75 per barrel compared with $64.19 per barrel in 2007. Exports of refined petroleum products were valued at $33.9 billion; petrochemicals, $16.7 billion; and construction materials and steel, about $3.4 billion (Saudi Arabian Monetary Agency, 2009, p. 144, 170, 388).

Production

Significant increases in production volume in 2008 were posted for copper, lead, and zinc, which were coproducts of the new Al Amar gold mine, which is located in Ar Riyadh Province about 195 kilometers (km) southwest of Riyadh. Clays, direct-reduced iron (DRI), feldspar, granite, and natural gas also posted significant increases in production volume. Smaller but notable (about 4% to 5%) production increases were posted for crude oil and refined petroleum. Notable decreases in output were posted for limestone blocks and sand and gravel. Data on mineral production are in table 1.

Structure of the Mineral Industry

The Deputy Ministry for Mineral Resources (2009, p. 3, 54, 75, 103, 111) reported that in 2008 there were 1,263 active mining and quarrying licenses and 145 active exploration and reconnaissance licenses. The Government maintained ownership interest in most of the large companies that operated in the mineral sector. The Government held 70% interest and the private sector held 30% interest in Saudi Basic Industries Corp. (SABIC). Subsidiaries of SABIC included Al-Jubail Fertilizer Co., National Chemical Fertilizer Co., Saudi Arabian Fertilizer Co., Saudi Iron and Steel Co. (Hadeed), and several petrochemical companies. In July, the Government divested 50% of its equity interest in Saudi Arabian Mining Co. (Ma'aden) through an initial public offering and retained a 50% interest in Ma'aden (table 2).

Exploration for and production of crude oil in Saudi Arabia were restricted to Saudi Arabian Oil Co. (Saudi Aramco), which formed joint ventures with international firms to explore for natural gas and to refine petroleum. The Ministry of Petroleum and Mineral Resources supervised its affiliate companies in the fields of minerals and petroleum; these included Aramco Gulf Operation Ltd., Ma'aden, and Saudi Aramco. Aramco Gulf Operation and Saudi Arabian Chevron Inc. (which was a subsidiary of Chevron Corp. of the United States) worked in the Partitioned Neutral Zone between Kuwait and Saudi Arabia on behalf of the Ministry. The Ministry also supervised the Saudi Geological Survey.

Commodity Review

Metals

Aluminum.—By October 2008, the estimated cost of construction of the aluminum project that the joint venture of

[1]Where necessary, values have been converted from Saudi Arabian riyal (SAR) to U.S. dollars (US$) at the fixed rate of SAR3.75=US$1.00.

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Ma'aden (51% equity interest) and Rio Tinto Alcan of Canada (49%) proposed to build increased to $10.6 billion from $7 billion in 2007 owing to significantly escalated construction costs and slight increases in refinery and smelter capacities. Rio Tinto Alcan withdrew from the project in December. Ma'aden remained committed to the development of the 3.5-million-metric-ton-per-year (Mt/yr)-capacity bauxite mine at Az Zabirah and the 1.8-Mt/yr-capacity alumina refinery and 2-potline 740,000-metric-ton-per-year (t/yr)-capacity smelter facility that was to be built at Ras al-Zawr, which is located about 90 km north of Jubail on the Persian Gulf. In 2008, Ma'aden began mining low-grade bauxite and kaolin at Az Zabirah. The low-grade bauxite was expected to be sold to cement companies (Karam, 2008).

Development work continued on Western Way for Industrial Development Co. of Saudi Arabia's 1.6-Mt/yr-capacity alumina refinery and 700,000-t/yr-capacity aluminum smelter complex and Sino-Saudi Jizan Aluminum Co.'s 1-Mt/yr-capacity aluminum smelter. Both facilities were expected to be built at the proposed Jizan Economic City (also known as Jazan Economic City), which was to be located about 60 km north of Jizan on the Red Sea. Emirates Aluminium Company Ltd. PSJC of the United Arab Emirates also proposed to build a 700,000-t/yr-capacity aluminum smelter in the planned King Abdullah Economic City, which was to be located north of Jeddah on the Red Sea (Shaheen, Tammar, and Al Ghalib, 2008, p. 9).

Copper, Gold, Silver, and Zinc.—Ma'aden began operations at Al Amar Mine in early 2008. The mine's annual production was anticipated to be about 200,000 t/yr of ore, from which about 6,500 metric tons (t) of zinc, 1,100 t of copper, 1,700 kilograms (kg) of gold, and 25 kg of silver were expected to be recovered. Ma'aden's mining operations at the Bulgah Mine were expected to cease in 2010; at the Al-Hajar Mine, in 2011; at the Mahd Adh-Dahab Mine, in 2013; and at the Al Amar Mine, in 2014. The Sukhaybarat ore processing plant was expected to close in 2014. Ma'aden and its subsidiaries (Ma'aden Gold and Base Metals Co. and Saudi Company for Precious Metals) explored for precious metals and associated minerals at Al Hajar, Garzaieh, Misca, Ourook, Shaktalieh, Sheba, Siham, Tawan, Umm ash Shalahib, and Warsha (Saudi Arabian Mining Co., 2006; 2009, p. 18; undated).

In 2008, Consolidated Mining Company Investments Ltd. of Saudi Arabia transferred the Jabal Sayid copper and gold project to Bariq Mining Ltd., which was a joint venture of Citadel Resources Group of Australia and Consolidated Mining. Bariq continued a resource-definition drilling program at Jabal Sayid, and a feasibility study of the project was expected to be completed in 2009. Citadel explored the Jabal Shayban copper and gold deposit in 2008 and planned to begin exploration of the Jabal Baydan zinc and Wadi Kamal nickel deposits in 2009.

Al Masane Al Kobra Mining Co. (AMAK), which was a venture of local investors and the Arabian American Development Co. of the United States, acquired the Al Masane mining license from Arabian American Development. AMAK began construction of facilities for the underground Al Masane Mine, which is located in southwestern Saudi Arabia; initial production was scheduled to begin in late 2009. At full capacity, annual mine output was expected to include 58,000 t of zinc concentrates (that contained 53% zinc); 34,900 t of copper concentrate (that contained 25% copper) and about 12 t of doré (that contained 98% silver and 2% gold) (Al Masane Al Kobra Mining Co., 2009, p. 14).

Iron Ore.—In January, National Mining Co. of Saudi Arabia (50% equity interest) and London Mining Plc (50%) formed Saudi London Iron Ltd. (SLI) to develop the Wadi Sawawin iron ore project. SLI began a preliminary feasibility study of a proposed 11.6-Mt/yr-capacity mine, which was to be located in northwestern Saudi Arabia about 52 km from the Red Sea, and a 5-Mt/yr-capacity seaside pelletizing plant that was expected to be completed in 2009 (London Mining Plc, 2009, p. 6-7).

Niobium (Columbium), Tantalum, Yttrium, and Zircon.—In 2008, no work was performed on the Ghurayyah tantalum prospect by the joint venture of Tertiary Minerals plc of the United Kingdom (50% equity interest) and Saudi partners A.H. Algosaiba & Bros. Co. and Al Nahla Trading and Contracting Co. (25% each). In early 2007, the Government did not renew the prospect's license; the joint venture subsequently applied for a new exploration license.

Industrial Minerals

Aluminum Fluoride, Clay and Shale, and Magnesite.—In 2006, Al Zamil Holding Co. of Saudi Arabia and Industries Chemiques du Fluor of Tunisia had formed a joint venture to build a 50,000-t/yr-capacity aluminum fluoride manufacturing plant near Jubail. Initial production, which tentatively had been scheduled for 2008, was pushed back to 2010 (Shaheen, Tammar, and Al Ghalib, 2008, p. 9).

In 2008, Ma'aden started mining at its 50,000-t/yr-capacity kaolin mine at Az Zabirah. Development work on the Zarghat magnesite deposit continued; a 150,000-t/yr-capacity mine at Zarghat was expected to be commissioned in 2010 (Dabbagh, 2009, p. 16).

Phosphate Rock.—In January, Ma'aden, which held 70% equity interest in the Al-Jalamid phosphate project, and SABIC, which held 30% interest, incorporated Ma'aden Phosphate Co. (MPC). MPC continued the development of the Al-Jalamid phosphate mine and the Ras Az Zawr fertilizer complex; initial production of diammonium phosphate fertilizer was expected in 2011.

Mineral Fuels

Petroleum.—To meet anticipated domestic and international demand for crude oil and to offset the natural production decline of older fields, Saudi Aramco had several projects underway to increase total production capacity. In August, production tests from the Khursaniyah project started; the project was expected to add about 500,000 barrels per day (bbl/d) of Arabian Light crude oil and natural gas liquids from the Abu Hadriyah, the Fadhili, and the Khursaniyah fields to Saudi Aramco's production capacity.

Other ongoing projects included the Khurais project, which was the planned development of the Abu Jifan and the Mazalij fields, which were projected to produce 1.2 million barrels per day of Arabian Light crude oil; the 250,000-bbl/d expansion of

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the Arabian Light crude oil production capacity at the Shaybah field; and the redevelopment of the Manifa field, which was expected to add 900,000 bbl/d of Arabian Heavy crude oil from onshore and offshore wells to Saudi Aramco's production capacity (Saudi Arabian Oil Co., 2009, p. 17-18).

Outlook

With its crude oil resources, Saudi Arabia is well placed to meet international demand for petroleum. Historically, sustained worldwide economic downturns and the resultant declines in demand for hydrocarbons have had significant negative effects on the national economy, but Saudi Aramco expects to continue its program to increase its production of premium-priced light and extra-light grades of crude oil.

In the long term, the Kingdom's privatization program and encouragement of private investment in mineral projects is expected to be attractive to international investors. Significant infrastructure development, which includes the establishment of new cities and the expansion of the highway and railroad network, will likely raise the short-term demand for construction minerals and products, such as cement, glass, sand, steel, and stone.

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TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
METALS						
Copper content of concentrate and bullion	metric tons	652	668	730	737	1,465
Ferroalloys[e]	do.	--	--	85,000	85,000	90,000
Gold content of concentrate and bullion	kilograms	8,268	7,456	5,180	4,440 r	4,527
Iron and steel:						
Low-grade iron ore, for cement	metric tons	503,500	582,000	584,000	642,000	581,000
Direct-reduced iron		3,410	3,630	3,580	4,340	4,970
Steel, crude		3,902	4,185	4,000	4,600	4,670
Lead content of concentrate[e]	metric tons	30	--	-- [3]	123 [3]	600
Silver content of concentrate and bullion	kilograms	14,494	13,501	9,100	9,028	8,232
Zinc content of concentrate	metric tons	1,500 e	--	983	716	3,663
INDUSTRIAL MINERALS						
Barite[e]	metric tons	15,000	15,000	23,308 [3]	30,000 [3]	30,000 [3]
Cement, hydraulic		25,370	26,064	27,056	30,369	31,823
Clays:						
Kaolin	metric tons	4,000 e	1,490	3,957	4,415	4,400
Other, for brick and tile		2,000 e	4,300	3,800	3,900	5,000
Feldspar	metric tons	80,000	42,300	42,300	73,000	550,000
Fertilizer, phosphatic, P_2O_5 content[e]		295	300	300	300	300
Gypsum, crude		641	713	2,101	2,100 r	2,300
Lime[e]		350	360	360	400	400
Nitrogen:						
N content of ammonia		1,726	1,780	2,000	2,600	2,600 e
N content of urea		1,242	1,250	1,400	1,850	1,850 e
Salt		1,530	1,738	1,752	1,507	1,600
Sand and stone:						
Aggregate		156,300	190,000	217,000	234,000	248,000
Basalt		NA	43	53	-- r	--
Dolomite		530	498	550	465 r	465
Granite		716	843	962	954	1,100
Limestone:						
Blocks		775	462	308	308	242
For cement		32,000	30,600	30,500	33,447	36,100
Marble	metric tons	82,000	84,700	84,700	85,000	85,000
Pozzolana and scoria		320	372	400	784	810
Sand and gravel		33,100	28,000	35,000	26,000	22,000
Silica sand (glass sand)		625	518	781	820	799
Sulfur, byproduct, hydrocarbon processing	metric tons	2,249,295	2,716,823	2,906,911	3,089,223	3,163,346
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	75,967	81,350	85,001	82,665	86,158
Dry (methane)	do.	52,100 r	57,400 r	60,300 r	61,900 r	68,100
Petroleum:						
Crude oil	million 42-gallon barrels	3,151	3,309	3,253	3,114	3,266
Condensate	do.	82	89	94	94	93
Natural gas liquids:						
Ethane	million cubic meters	10,100	11,200	10,600	10,700	10,600
Propane	thousand 42-gallon barrels	148,225	150,588	149,320	143,681	146,048
Butane	do.	91,060	94,148	94,338	92,684	94,483
Natural gasoline and other	do.	65,647	66,299	61,456	63,926	68,195
Refinery products:						
Liquefied petroleum gases	do.	13,400	12,740	14,730	11,521	11,300
Gasoline and naphtha	do.	198,570	198,870	186,420	188,644	200,610
Jet fuel and kerosene	do.	66,980	80,910	77,330	67,282	69,680
Distillate fuel oil	do.	234,890	236,370	241,790	238,496	247,440
Residual fuel oil	do.	172,790	177,970	181,000	174,385	174,380
Unspecified[4]	do.	11,490	13,780	14,160	15,041	17,960
Total	do.	698,120	720,640	715,430	695,369	721,370

See footnotes at end of table.

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TABLE 1—Continued
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available. -- Zero.
[1]Table includes data available through November 20, 2009.
[2]In addition to commodities listed, low-grade bauxite, carbon black, and methanol were produced, but available information is inadequate to make reliable estimates of output.
[3]Reported figure.
[4]Includes asphalt.

TABLE 2
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Bauxite, low-grade for cement		Saudi Arabian Mining Co. (Ma'aden) (Government, 50%)	Central zone, Az Zabirah area	250,000
Cement:				
Grey portland		Yamama Cement Co. Ltd.	Riyadh	4,600
Do.		Yanbu Cement Co.	Yanbu	4,600
Do.		Saudi Cement Co.	Al Hofuf, about 120 kilometers southwest of Dammam	4,000
Do.		do.	Ayn Dar, about 120 kilometers southwest of Dammam	1,450
Do.		Najran Cement Co.	About 160 kilometers northwest of Najran	4,000
Do.		Eastern Province Cement Co.	Al Khursaniyah	3,500
Do.		Qassim Cement Co.	Jal al Watah, 18 kilometers north of Buraydah	3,500
Do.		Arabian Cement Co. Ltd.	Rabigh	3,100
Do.		Southern Province Cement Co. (Government, 52%)	Suq Al Ahad, 10 kilometers northeast of Jizan	2,600
Do.		do.	Bishah, 550 kilometers southeast of Jiddah	2,000
Do.		do.	Tihama	1,800
Do.		Northern Region Cement Co.	About 190 kilometers west-northwest of Arar	2,000
Do.		Riyadh Cement Co.	About 30 kilometers southwest of Riyadh	1,700
Do.		Tabuk Cement Co.	Tabuk	1,500
Do.		Al Safwa Cement Co. (Khayyat Group, 50%, and Lafarge Cement S.A., 50%)	Jabal Farasan	1,400 [1]
Do.		Al Jouf Cement Co.	South of Turaif	1,500 [1]
White		Al-Gharbiah Cement Factory	Jeddah	250
Do.		Saudi White Cement Co.	About 30 kilometers southwest of Riyadh	200
Copper, Cu content of ore		Saudi Arabian Mining Co. (Ma'aden) (Government, 50%)	Al Amar Mine, Ar Riyadh Province and Mahd Adh-Dahab Mine, Al Madinah Province	1,000
Gold	kilograms	do.	Al Amar Mine, Ar Riyadh Province; Al-Hajar Mine, Asir Province; Bulgah Mine,[2] Al Madinah Province; Mahd Adh-Dahab Mine, Al Madinah Province; and Sukhaybarat plant,[2] Al Madinah Province	8,000
Kaolin		do.	Central zone, Az Zabirah	50,000
Petroleum:				
Crude	million barrels	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Eastern Province, Najd Region, and offshore; includes the Ghawar, the Hawtah, the Safaniya, and the Shaybah fields	3,900
Refined products	do.	do.	Ras Tanura	193
Do.	do.	Rabigh Refining & Petrochemical Co. (PetroRabigh) [Saudi Arabian Oil Co. (Saudi Aramco), 50%, and Sumitomo Chemical Co., 50%]	Rabigh	140 [3]
Do.	do.	Saudi Aramco Mobil Refinery Co. Ltd. [Saudi Arabian Oil Co. (Saudi Aramco), 50%, and Mobil Yanbu Refining Company Inc., 50%]	Yanbu	140
Do.	do.	Saudi Aramco Shell Refining Co. [Saudi Arabian Oil Co., (Saudi Aramco), 50%, and Shell Saudi Arabia Refining Ltd., 50%]	Al Jubayl	110
Do.	do.	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Yanbu	82
Do.	do.	Riyadh Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Riyadh	50
Do.	do.	Jeddah Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Jeddah	38

See footnotes at end of table.

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TABLE 2—Continued
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Steel, crude	Saudi Iron and Steel Co. (Hadeed) (Saudi Basic Industries Corp. (SABIC), 100%)	Al Jubayl	2,700
Do.	National Steel Co. Ltd. (Al Tuwairqi Group, 100%)	Dammam	800
Titanium dioxide	The National Titanium Dioxide Co. Ltd. (Cristal) (Gulf Investment Corp. of Kuwait; National Industrialization Co. of Saudi Arabia; Shairco Trading Industry and Contracting of Saudi Arabia)	Yanbu	100
Zinc, Zn content of ore	Saudi Arabian Mining Co. (Ma'aden) (Government, 50%)	Al Amar Mine, Ar Riyadh Province and Mahd Adh-Dahab Mine, Al Madinah Province	2,000

Do., do. Ditto.
[1]Under construction.
[2]The Bulgah Mine and the Sukhaybarat plant are operated by the Saudi Company for Precious Metals, which is a subsidiary of Saudi Arabian Mining Co. (Ma'aden).
[3]Rabigh Refining & Petrochemical Co. (PetroRabigh) was formed in late 2008 as a joint venture of Saudi Aramco and Sumitomo Chemical Co. PetroRabigh will operate the Rabigh refinery formerly managed by Saudi Aramco subsidiary Rabigh Petroleum Refining Co.

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The Mineral Industry of Syria

By Mowafa Taib

Oil and phosphate rock were Syria's significant contributions to the world supply of minerals in 2008. Syria, which produced about 2% of the world's phosphate rock output, was the world's eighth ranked phosphate rock producing country (Jasinski, 2009). The Government-owned oil and gas companies, along with several small oil and gas companies from Canada, China, and the United Kingdom (in the absence of U.S. companies because of the sanctions that were imposed on Syria by the U.S. Government in 2004) carried out substantial exploration, development, and production activities in 2008. There was significant activity in the cement industry, which included the entry of private investors (Al Badia Cement JSC) and foreign investors (Lafarge Cement Syria S.A.) to the cement market for the first time. Other minerals and mineral-related materials that were produced in Syria included asphalt, fertilizer, gypsum, marble, rock salt, silica sand, steel, and volcanic tuff. Except for crude oil and phosphate rock, which were both exported and consumed locally, most of the production of other minerals was solely for domestic use.

Minerals in the National Economy

In 2008, Syria's gross domestic product (GDP) grew at a rate of 5.2% compared with a rate of 4.2% in 2007. The 2008 level of oil production was the same as in 2007 [380,000 barrels per day (bbl/d)]. A preliminary estimate of the revenue of the hydrocarbon sector in 2008 was 5.2% of the GDP, which was slightly more than that of 2007 (4.9% of the GDP) but much less than the revenue in 2004, which was 11.2% of the GDP. Exports of crude oil in 2008 were estimated to be about 100,000 bbl/d, which was significantly less than the 153,200 bbl/d exported in 2007. The reduction in crude oil exports was attributable to the increase in local consumption. About 3 million metric tons (Mt) of washed and unwashed phosphate rock was sold mainly to foreign fertilizer manufacturers (International Monetary Fund, 2009a, p. 39; 2009b, p. 10; 2009c, p. 5).

Production

In 2008, production of gypsum increased by 28% compared with that of 2008; natural gas plant liquids, by 21%; and volcanic tuff, by 13%. Marble block production decreased by 43%; phosphate rock, by 12%; and asphalt, by 11% compared with that of 2007 (table 1).

Structure of the Mineral Industry

Most mining activity was carried out by the Ministry of Petroleum and Mineral Resources (MoPMR) through state-owned companies and organizations. These included the General Company for Marble and Asphalt, which produced asphalt, gypsum, marble blocks, and volcanic tuff; the General Company for Phosphate and Mines, which produced phosphate rock, silica sand, and rock salt; the Syrian Petroleum Co., which produced crude oil; and the Syrian Gas Co., which was responsible for the natural gas subsector. The Ministry of Industry was responsible for cement production, which continued to be dominated by the state-owned company General Organization for Cement and Building Materials. Several private and international investors were also able to acquire permits for cement production in areas designated by the General Establishment for Geology and Mineral Resources as locations that had sufficient primary material for cement production. Fertilizers were produced by the General Fertilizers Co., which was one of the state-owned enterprises of the Ministry of Industry's General Organization for Chemical Industries. State-owned General Company for Iron and Steel Products, which was also known by its Arabic name Hadeed Hama, produced rolled steel and billets. Private beneficiated steel producers included Arab Steel Co., Joudco Steel Ltd., Middle East Steel Industries, and Syria Metal Industries.

Commodity Review

Metals

Iron and Steel.—Imports of steel products had been increasing in recent years to meet the needs of commercial, industrial, and residential construction projects in the country. Syria's steel imports in 2007 (the latest year for which data were available) totaled 2.8 million metric tons per year (Mt/yr) compared with 1.8 Mt/yr in 2003, which was about a 15% annual increase from 2003 to 2007. In 2008, Hadeed Hama produced 54,363 metric tons (t) of crude steel from its scrap melting plant compared with 68,502 t in 2007. The company used its crude steel output and imported iron ore to produce 63,040 t of steel bars in 2008 compared with 70,008 t in 2007. In June, Hadeed Hama awarded Apollo Metalex Pvt. Ltd. of India a turnkey contract worth $34 million to upgrade its scrap melting plant; the contract was expected to increase the plant's capacity to produce billets to 300,000 metric tons per year (t/yr) from 70,000 t/yr by 2010 (Arab Steel, 2008; Syrian Enterprise Business Center, 2008).

Joudco Steel, which was a private steel production company whose headquarters were located in Latakia, produced 133,000 t of reinforcement bars in 2008, of which 15,740 t was exported. The company was building a new 512,000-t/yr-capacity plant in the Adra Industrial City northeast of Damascus for the production of hot-rolled billets (Joudco Steel Ltd., 2007; Syrian Enterprise Business, Center, 2008).

In 2007, Syria Metal Industries (a subsidiary of Hamsho International Group Ltd.), which was headquartered in Latakia, placed an order with SMS Meer p.l.c. of Italy to supply a 300,000-t/yr-capacity wire rod and bar mill, which would be used in producing low- and medium-carbon-content rebar. The mill began production at yearend 2007. Syria Metal

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Industries planned to build a new billets plant in Adra Industrial City, which would have a nominal capacity of 630,000 t/yr, and expected Daniel Centro Metal Co. of Italy to supply the electric arc furnace, the ladle furnace, and a four-strand billet continuous-casting machine (Steel News, 2007; Syrian Enterprise Business Center, 2008; Hamsho International Group Ltd., 2009).

Industrial Minerals

Cement.—Demand for cement had been exceeding production for many years. In 2008, Syria's cement consumption was estimated to be more than 7.3 Mt/yr whereas production of the six state-owned plants totaled 5.3 Mt/yr. The country resolved its difference between consumption and production by importing 1.7 Mt/yr of cement from Lebanon and Turkey. Thus, the Government considered it crucial to increase local cement production levels to satisfy current and future demand caused by the construction boom, which resulted from expanded commercial, industrial, and residential projects (Lafarge Cement Syria S.A., 2009).

In 2008, Lafarge S.A. entered the Syrian cement market through its acquisition of Orascom Industries S.A. of Egypt, which was a major shareholder (80% interest) along with Mas Economic Group of Syria (20% interest) in the joint venture Syrian Cement Co. Syrian Cement, which was also known as Lafarge Cement Syria, was building a new plant in Manbej, which is located 160 kilometers (km) northeast of Aleppo and 25 km south of the border with Turkey. In July 2008, Banque Audi, which was a private bank operating in Syria, offered $380 million as a bridge loan to finance the plant, which would have a production capacity of 3 Mt/yr and would begin production in the first quarter of 2010 (Orascom Construction Industries, 2007; Thomson Reuters, 2008).

Al-Badia Cement Co. JSC, which was one of the first private companies to secure a license to build a cement plant, signed a memorandum of understanding (MOU) with CBMI Construction Co. Ltd. of China to construct a new 3.2-Mt/yr-capacity plant at Abu As-Shamat, which was located east of Damascus. Production at the plant was expected to commence in late 2010. Al-Badia made 15% of its shares available to individual investors (AMEinfo.com, 2008a).

Phosphate Rock.—Syria's phosphate rock industry, which employed more than 2,000 people, produced 3.2 Mt in 2008 compared with 3.7 Mt in 2007, or 12% less than in 2007 and 15% less than the General Company for Phosphate and Mines' production target for 2008. Several reasons were given by the company for the significant decrease in production, including insufficient mining equipment and technical difficulties, which caused interruption in the washing process, and the "intentional 25% reduction in exports during the first half of 2008 to force a higher price for rock phosphate," according to an official report. The price of phosphate rock from Syria reached $70 per metric ton in early 2008 compared with $30 per metric ton in 2006. Of the phosphate rock produced in 2007, about 650,000 t was used by General Fertilizers Co. for manufacturing phosphate fertilizer and about 900,000 t was exported to Lebanon; the remainder was exported to 12 other countries. The decrease in phosphate rock production was considered a setback for recovery efforts by the mining industry and to the Government policy of using phosphate reserves to offset the loss of revenue caused by the expected reduction in hydrocarbon exports (Ministry of Petroleum and Mineral Resources, 2009).

The Governments of India and Syria signed an MOU in 2008 to establish a joint venture to explore and mine Syria's rock phosphate deposits to meet India's needs for phosphate fertilizers in general, and diammonium phosphate (DAP) in particular (Sharma, 2008).

Stone, Crushed (Volcanic Tuff).—Volcanic tuff occurs throughout eastern Syria, including in the region between Abu Ashamat and Sababiar, which is located south of the Baghdad-Damascus highway. Reserves were estimated to be 600 Mt, which was sufficient to support production of 10 Mt/yr of pozzolan cement for 60 years. The production cost of pozzolan cement in Syria was estimated to be 25% lower than that of portland cement (Buildex, 2009). The General Company for Marble and Asphalt produced 901,226 t of volcanic tuff in 2008 compared with 810,000 t in 2007 (Ministry of Petroleum and Mineral Resources, 2009).

Mineral Fuels

Natural Gas.—In 2008, production commenced at the Dubayat oilfield at a rate of 44,000 cubic meters per day. First gas from the Arak gasfield started in February 29, 2008, at a rate of 45,000 cubic meters per day. Production from the Abu Rabah gasfield, which is located in the Homs Governorate, started in late 2008. It was expected to produce 1.5 to 2.0 million cubic meters per day of gas and 1,200 to 1,400 bbl/d of condensates.

Syria's natural gas production in 2008 amounted to 7.6 billion cubic meters. Syrian Gas produced about 5.6 billion cubic meters of dry and associated gas and international companies working in Syria produced close to 2.0 billion cubic meters. Sixty-five percent of the gas produced was put into the country's gas network for local consumption.

The construction of Phase 1 of the Arab Gas Pipeline (AGP) by Stroytransgaz PJSC of Russia for Syrian Gas was completed in 2008. It comprised a 320-km-long pipeline that runs from the Jordanian-Syrian border to the Al Rayan gas collection station in Homs. Construction of Phase 2 of the AGP was also awarded to Stroytransgaz by Syrian Gas to construct a 62-km-long pipeline that would extend from the Syrian city of Aleppo to the town of Kilis on the Syrian-Turkish border, thus allowing for AGP to be connected with the planned network of gas pipelines (Nabucco) that would transmit gas from Azerbaijan, Iran, and Iraq to Austria, Bulgaria, Hungary, and Romania and through Turkey. The cost of the project was $60 million, and it was expected to be completed in 18 months (Organization of Arab Petroleum Exporting Countries, 2008b, p. 13; U.S. Energy Information Administration, 2008).

The Governments of Iran and Syria signed a 25-year agreement in January 2008 by which Iran would supply natural gas during the summer months to Syria. The gas was planned to flow through the Tabriz-Ezrurum gas pipeline, which would be connected with AGP from the south. The flow of Iranian gas

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into Syria was set to begin in 2009 (Aneja, 2007; U.S. Energy Information Administration, 2008).

In March 2008, Petrofac Ltd. of the United Kingdom was awarded a $454 million lump-sum contract by Hayan Petroleum Co. to build a gas treatment plant on the Jihar oilfield in the Hayan Block. The Hayan oilfield is located near the city of Palmyra in the central part of Syria. Hayan Petroleum Co. was a 50-50 joint venture between Syrian Petroleum and INA Industrija Nafte d.d. Naftaplin of Croatia (Petrofac Ltd., 2008b).

In April 2008, Petrofac was chosen by Petro Canada Palmyra to build a natural gas treatment plant for the Ebla project at a cost of $477 million. The Ebla project, which was operated by Petro Canada, was a production-sharing agreement to develop and produce natural gas from the Ash Shaer and the Cherrife oilfields. The first gas was expected in 2010, and the daily production capacity of the project was expected to be 2,492 t (88 million cubic feet) of salable gas and 150 t of liquefied petroleum gas (Petrofac Ltd., 2008a).

Petroleum.—Crude oil production in Syria averaged 380,000 bbl/d in 2008, which was the same level as in 2007. It included 196,000 bbl/d (206,000 bbl/d, including condensates) by Syrian Petroleum and 184,000 bbl/d by the international companies working in Syria.

In September 2008, the MoPMR and Syrian Petroleum signed a 10-year extension of their production service contract with Syria Shell Petroleum Development B.V. Total S.A. also signed three agreements that were intended to strengthen Total's long-term presence in the country. The first agreement renewed the Deir Azzor oil license, which was wholly owned by Total and jointly operated by Total and Syrian Petroleum as the Deir Ezzor Petroleum Co. The second agreement was about enhancing the output from the Tabiyeh gas and condensates field. The third agreement was an MOU between Total, Syrian Petroleum, and Syrian Gas to set up a strategic partnership for the development of joint projects among the three companies (Organization of Arab Petroleum Exporting Countries, 2008a, p. 12).

Gulfsands Petroleum p.l.c. of the United Kingdom, which announced an oil and gas discovery in 2007 at Block 26 of the Khurbet East field located northeast of Syria, started oil production in 2008 with an average of 10,500 bbl/d from five wells that were estimated to have 2 million barrels (Mbbl) of cumulative production. Gulfsands, which was the operator and a 50-50 equity shareholder with Syrian Petroleum, conducted an open-hole-stem test at the Yousefieh-1 well and an appraisal for the Yousefieh-2 well in 2008 (Gulfsands Petroleum p.l.c., 2009).

China Petroleum and Chemical Corp. (Sinopec), which was a state-owned oil company of China, bought Tanganika Oil Co. of Canada for $2 billion in September 2008. Tanganika Oil had been developing with Syrian Petroleum the Oudeh, the Sheik Mansour, and the Tishrine concessions (which are located in northeastern Syria) since 2003. The concessions were reported to hold 180 Mbbl of oil reserves and to have produced 12,800 bbl/d in 2008. China National Petroleum Corp. (another state-owned company of China) held a stake in Al-Furat Petroleum Co., which produced 170,000 bbl/d in 2008 from its 36 oilfields (AMEinfo.com, 2008b).

Outlook

The Government has been trying to halt the decline of oil production by developing its hydrocarbon resources and entering into production-sharing agreements with companies from Canada, China, and Russia. In the next 5 years, Syria is expected to be connected with neighboring countries through a network of gas pipelines that will allow the flow of natural gas from Egypt to Turkey through Jordan and Syria. Thus, the country expects to import gas from Azerbaijan and Iran through Turkey after the connecting pipelines are completed in 2010. Production of fertilizer and phosphate rock is expected to increase significantly following the establishment of joint ventures between the Government-owned phosphate mining company and international fertilizer companies. Such companies could be more capable of applying advanced mining technologies and investing in the logistics and transportation of phosphate rock from the production mines to the Port of Tartus for export. The entry of private local and international producers would likely increase the country's production capacity of cement and steel. The Government invited international companies to invest in its reserves of asphalt, bentonite, volcanic tuff (pozzolan), and zeolite.

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TABLE 1
SYRIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008
METALS						
Steel:[e]						
Crude		70,000	70,000	70,000	70,000	70,000 [2]
Semimanufactured		800,000 [2]	800,000	800,000	80,000	100,000
INDUSTRIAL MINERALS						
Asphalt		NA	NA	NA	56.402	50,011
Cement, hydraulic	thousand metric tons	4,757	4,700	4,804 [r]	5,104 [r]	5,336
Gypsum		431,561	467,000	443,800	447,900	572,886
Nitrogen:						
N content of ammonia[e]		115,000	120,000	120,000	120,000	120,000
N content of urea[e]		91,000	91,000	91,000	91,000	91,000
Phosphate:						
Phosphate rock, mine output:						
Gross weight	thousand metric tons	2,883	3,500	3,664	3,678	3,221
P_2O_5 content	do.	890	1,080	1,130	1,135	966
P_2O_5 equivalent:						
Phosphatic fertilizers[e]		127,000	130,000	130,000	130,000	120,000
Phosphoric acid[e]		97,000	100,000	100,000	100,000	100,000
Salt, rock		141,445	110,000	133,000	81,000	88,600
Sand, industrial	thousand metric tons	1,300	1,300	1,300	1,702	1,621
Stone:						
Dolomite, refractory grade[e]	do.	5,000	5,000	5,000	5,000	5,000
Gravel and crushed rock[e]	do.	6,000	6,000	6,000	6,000	6,000
Marble materials	do.	NA	NA	NA	780	885
Marble blocks	thousand square meters	340	340	340	350	198
Volcanic tuff	thousand metric tons	650	650	650	810 [r]	901
Sulfur:						
Byproduct of petroleum and natural gas		14,996	36,074	43,000	40,650	40,491
Sulfuric acid:						
Gross weight[e]		362,000	360,000	360,000	360,000	360,000
S content[e]		118,000	117,000 [e]	117,000	117,000	117,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross[e]	million cubic meters	9,700	8,300	8,600	7,825 [r,2]	7,574 [2]
Dry	do.	7,110	6,090	6,290	6,020	6,420
Natural gas plant liquids[e]	thousand 42-gallon barrels	3,650	3,650	3,650	3,650	4,415 [2]
Petroleum:						
Crude	do.	168,630 [r]	157,315 [r]	146,000 [r]	138,850 [r]	139,081
Refinery products:						
Liquefied petroleum gas	do.	3,318	3,805	3,724	1,680	1,680
Gasoline	do.	11,413	12,958	12,921	12,921	12,958
Naphtha	do.	7,028	7,456	7,456	7,100	7,100
Kerosene and jet fuel	do.	3,139	3,248	3,248	3,248	3,250
Distillate fuel oil	do.	30,758	27,341	29,348	29,346	29,346
Residual fuel oil	do.	30,210	30,942	32,887	32,887	32,887
Asphalt[e]	do.	2,500	2,500	2,500	2,500	2,500
Other[e]	do.	900	900	900	900	900
Total	do.	89,266	89,150	92,984	90,582	90,621

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. NA Not available.
[1]Table includes data available through March 31, 2010.
[2]Reported figure.

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TABLE 2
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Asphalt		General Company for Marble and Asphalt (Government, 100%)	Al Bishri, Kafriya	100
Cement		General Organization for Cement and Building Materials (Government, 100%)	Damascus	5,200
Do.		Tartous Company for Cement and Building Materials[1]	Tartous	1,802
Do.		Al-Shahaba Cement and Building Materials[1]	Aleppo	923
Do.		Arabian Cement Co. for Cement[1]	do.	898
Do.		Adra Co. for Cement and Building Materials[1]	Adra	845
Do.		Syrian Co. for Manufacturing Cement[1]	Hama	432
Do.		Rastan Co. for Cement and Building Materials[1]	Rastan	131
Do.		Military Housing Cement Group (Government, 100%)	Musselemieh	336
Gypsum		General Company for Marble and Asphalt (Government, 100%)	Ar Reqqah, Jayrud, Lattakia	573
Natural gas	million cubic meters	Syrian Gas Co. (Government, 100%)	Processing plant at Deir ez-Zor	4,750
Do.	do.	A-Furat Petroleum Co. (Syrian Petroleum Co., 50%; Petro-Canada, 19%; Royal Dutch/Shell Group p.l.c., 31%)	Processing plant at Omar	2,400
Do.	do.	Syrian Gas Co. (Government, 100%)	Abu Rabah, Al -Fayed north, Qumqum, Bilas, Al-Rasm, and Abu al-dhuhr	1,825
Do.	do.	do.	Arak	13,770
Do.	do.	do.	Dubayat	14,872
Do.	do.	Syrian Petroleum Co. (Government, 100%)	Processing plant at Palmyra	2,200
Do.	do.	do.	Processing plant at Jebissa	1,060
Do.	do.	do.	Processing plant at Suwaidiyah	240
Nitrogen:				
Ammonia[2]		General Fertilizers Co. (Government, 100%)	Homs	256
Urea		do.	do.	137
Fertilizers		do.	do.	109
Marble materials		General Company for Marble and Asphalt (Government, 100%)	Zobar, Lattakia, and Sabboura	90
Petroleum:				
Crude	thousand 42-gallon barrels	Al-Furat Petroleum Co. (joint venture of Syrian Petroleum Co., Syria Shell Petroleum Development B.V., Himalaya Energy Services BV)	Al Izba, Al Ward, Galban, Jarnof/Saban, Maleh/Azraq, Omar/Omar North, Sijan, Tanak, and Thayyam	43,800
Do.	do.	Syrian Petroleum Co. (Government, 100%)	Jebissa and Swaidiyah-Karatchok	73,000
Do.	do.	Deir Ezzor Petroleum Co. (Syrian Petroleum Co., 50%, and Total S.A., 50%)	al-Mazraa, Attala North, and Jafra, Qahar	10,950
Do.	do.	Sino Syrian AL Kawkab Oil Co. [Syrian Petroleum Co., 50%, and China Petroleum and Chemical Corp. (Sinopec), 50%]	Oudeh	3,650
Do.		Dublin International [Syrian Petroleum Co., 50%, and Dublin International (Syria) Ltd., 50%]	do.	7,300
Refined	do.	Banias Refinery Co. (Government, 100%)	Banias	59,090
Do.	do.	Homs Refinery Co. (Government, 100%)	Homs	58,578
Phosphate:				
Phosphate rock		General Company for Phosphate and Mines (Government, 100%)	Alsharqiya (A and B Mines)	3,050
Do.		do.	Kneifis	800
Phosphatic fertilizers		General Fertilizers Co. (Government, 100%)	Homs	450
Phosphoric acid		do.	do.	165
Salt		General Company for Phosphate and Mines (Government, 100%)	Deir al-Zour	72
Steel:				
Billet		General Company for Iron and Steel Products (Hadeed Hama) (Government, 100%)	Hama	60
Rolled		Merri Family	Tartous	300
Do.		Arab Steel Co.	Lattakia	250
Do.		Joudco Steel Ltd.	do.	150
Do.		Middle East Steel Industries	Yabroud	140
Do.		General Company for Iron and Steel Products	Hama	78

See footnotes at the end of the table.

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TABLE 2—Continued
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Sulfur	metric tons	Homs Refinery Co.	Homs	14,600
Do.	do.	do.	Processing plant at Suwaidiyah	7,410
Do.	do.	Syrian Petroleum Co. (Government, 100%)	Processing plant at Jebissa	7,300
Sulfuric acid		General Fertilizers Co. (Government, 100%)	Homs	560
Volcanic tuff		General Company for Marble and Asphalt (Government, 100%)	Tal Shihan	100
Do., do. Ditto.				

[1] Subsidiary of the General Organization of Cement and Building Materials, which is 100% Government owned.
[2] Expressed in nitrogen equivalent.

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The Mineral Industry of Turkey

By Philip M. Mobbs

Turkey had a diverse mineral industry and was a leading producer of barite, bentonite, boron minerals, chromite, feldspar, kaolin, limestone, magnesite, marble, perlite, and pumice. Turkey also was a significant source of value-added processed mineral commodities, such as cement, ceramics, ferrochromium, glass, and steel. The volume of hydrocarbons produced in Turkey was small, but the country was a significant transit corridor for crude oil and natural gas shipments (Papp, 2009, p. 17.25-17.26; World Steel Association, 2009; Angulo, 2010; Bolen, 2010; Cordier, 2010; Crangle, 2010; Kramer, 2010; Miller, 2010; van Oss, 2010; Virta, 2010).

Minerals in the National Economy

The mining and quarrying sector accounted for about 0.80% of the real gross domestic product (GDP) (when calculated at 1998 producers' prices) in 2008, which was slightly up from about 0.76% of the GDP in 2007. The construction sector accounted for 5.90% of the GDP in 2008 compared with 6.49% in 2007 (Türkiye İstatistik Kurumu, 2010b).

Government Policies and Programs

Article 168 of the Constitution (1982) and the Mining Law of June 15, 1985 (Maden Kanunu, law No. 3213), declared that natural resources, such as minerals, belonged to the state and were not considered to be part of the land where they were found. Law No. 5177 of 2004 (the new mining law, which amended the 1985 mining law), the Regulation Concerning the Implementation of the Mining Law (which was issued in 2005), the Mining Activities Permitting Regulation of 2005, and the Law on Boron Minerals, Trona and Asphaltit Mines and Exploitation of Nuclear Energy Raw Materials No. 3971 of February 19, 1994, also regulated mining activity in Turkey. The Government issued licenses to Turkish individuals or legal entities to explore for minerals or operate mines for a specific period of time. The Foreign Direct Investment Law of June 2003 (law No. 4875) authorized foreign investors to establish companies in Turkey that could hold mining rights under the Mining Law.

Maden İşleri Genel Müdürlüğü [General Directorate of Mining Affairs] of the T.C. Enerji ve Tabii Kaynaklar Bakanlığı [Ministry of Energy and Natural Resources] regulated the mining industry. T.C. Çevre ve Orman Bakanlığı [Ministry of Environment and Forestry] enforced the Environmental Law of 1983 (law No. 2872) and the Regulation on Environmental Impact Assessment of December 16, 2003. State-owned Eti Maden İşletmeleri Genel Müdürlüğü retained exclusive rights to explore for and develop boron deposits according to law No. 2840 of 1983.

Petroleum exploration and production were administered by the Ministry of Energy and Natural Resources under the Petroleum Law of 1954 (law No. 6326). The distribution, export, import, refining, and sale of petroleum were licensed under and regulated by the Petroleum Market Law of 2003 (law No. 5015). The distribution, export, import, and transmission of natural gas were regulated by the Natural Gas Market Law of 2001 (law No. 4646), as amended by law No. 5367 of 2005. The marketing of domestic and imported liquefied petroleum gases was regulated by the Liquefied Petroleum Gases (LPG) Market Law of 2005 (law No. 5307).

Production

Most production data for 2008 are estimated (table 1). Significant increases in production in 2008 were noted for chromium, coke, gasoline, gold, lignite, and nitrogen (ammonia). Notable decreases in production in 2008 were posted for refined copper, ferrochromium, iron ore, strontium, and several refined petroleum products.

Structure of the Mineral Industry

The private sector dominated the country's industrial minerals and metals sectors. In 2008, 874 new mining and quarrying companies were established in Turkey, and 46 mining and quarrying companies were closed. Table 2 lists notable mineral commodity production and processing facilities (Türkiye İstatistik Kurumu, 2009).

Mineral Trade

In 2008, total Turkish exports of goods were valued at about $132 billion compared with $107.2 billion in 2007. Of the total exports in 2008, iron and steel accounted for about $14.9 billion; manufactured articles of iron and steel, $14.9 billion; mineral fuels, $7.5 billion; jewelry and precious or semiprecious stones, $5.3 billion; aluminum and aluminum articles, $1.8 billion; glass and glassware, $1 billion; building stone (crude and processed), $813 million; borates and boron chemicals, more than $500 million; chromium ore, $496 million; and copper ore and concentrates, about $320 million (İstanbul Maden ve Metallar İhracatçi Birlikleri Genel Sekreterliği, undated; Türkiye İstatistik Kurumu, 2010a, table 4).

Total imports were valued at about $202 billion in 2008, of which mineral fuels accounted for about $48.3 billion, and iron and steel, about $23.2 billion. A significant percentage of the iron and steel imports was steel scrap (Türkiye İstatistik Kurumu, 2010a, table 5).

Commodity Review

Metals

Bauxite and Alumina.—Albuck Madencilik San. ve Tic. A.Ş., which had begun mining diaspore at Mugla in 2007,

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started another mining operation in the Eskisehir area in 2008. The company planned to ramp up production from the two mines to about 300,000 metric tons per year (t/yr) (Albuck Madencilik San. ve Tic. A.Ş., 2009).

Copper, Gold, and Zinc.—Mining operations at the Kişladag gold mine, which was owned by Eldorado Gold Corp. of Canada, were resumed in March 2008 after being suspended in August 2007 owing to a court injunction related to litigation concerning the mine's environmental certificate. The litigation remained under appeal at yearend. Despite the nearly 3-month suspension of operations at Kisladag, Tüprag Metal Madencilik San. ve Tic. A.Ş., which was a subsidiary of Eldorado, produced about 4,200 kilograms of gold from the open pit mine. In June, Eldorado resumed work at the Efemcukuru underground gold project, which was also subject to a lawsuit concerning the mine's environmental certificate. The decision by the Fourth Administrative Court to deny the litigation to cancel the environmental certificate for Eldorado's Efemcukuru project was appealed by the third-party litigant to the Sixth Department of High Administrative Court, which in turn denied the appeal in January 2009 (Eldorado Gold Corp., 2009, p. 19-21).

In 2008, Çayeli Bakır İşletmeleri A.Ş., which was a subsidiary of Inmet Mining Corp. of Canada, mined 1.1 million metric tons of ore from the Çayeli Mine to produce concentrates containing 47,600 metric tons (t) of zinc and 32,700 t of copper. In March, an injunction resulted in yet another suspension of the development work at the Cerattepe underground copper-zinc mine. In October, the operating licenses for the Cerattepe Mine that were held by Artvin Bakır İşletmeleri A.Ş., which was a subsidiary of Çayeli Bakır İşletmeleri A.Ş., were cancelled by the Rize Administrative Court. The Turkish Ministry of Energy and Natural Resources (and co-defendant Inmet) appealed the decision to cancel the licenses to the Turkish Administrative Supreme Court, Inmet subsequently decided not to proceed with the Cerattepe project (Inmet Mining Corp., 2009, p. A13).

Iron and Steel.—In November, Borçelik Çelik San. ve Tic. A.Ş., which was a joint venture of ArcelorMittal and Borusan Holding A.Ş., started production from a 600,000-t/yr-capacity cold-rolling line at the company's facility near Gemlik. In 2008, Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir) completed the rehabilitation of blast furnace no. 1, and İskenderun Demir ve Çelik A.Ş. (Isdemir), which was a subsidiary of Erdemir, commissioned a 3.5-Mt/yr-capacity hot-strip mill. In 2008, Isdemir also commissioned burnt lime plant no. 8 and slab casting machine no. 2 and started production from coke battery no. 6 (Borçelik Çelik San. ve Tic. A.Ş., 2008; İskenderun Demir ve Çelik A.Ş., 2009).

Concast A.G. of Switzerland continued work near Biga on a 1.5-Mt/yr-capacity electric-arc-furnace steel plant for İçdaş Demir Çelik Enerji Tersane ve Ulaşım Sanayi A.Ş. The plant was expected to be commissioned in late 2009. İlhan Metalurji A.Ş. began production at its 220,000-t/yr-capacity steel plant. Kocaer Haddecilik San. ve Tic. Limited ŞTI commissioned a third rolling mill. Karabük Demir Çelik San. ve Tic. A.Ş. (Kardemir) commissioned its fourth blast furnace. The new 450,000-t/yr-capacity furnace increased Kardemir's steelmaking capacity to 1.45 Mt/yr. Mega Demir Mamulleri Sanayi ve Ticaret Limited ŞTI started up a 220,000-t/yr-capacity steel plant in May (Orion Investment Menkul Değerler A.Ş., 2008; Rolmet Makina Pazarlama San.ve Tic. Ltd. ŞTI, 2008; Concast A.G., undated).

In December, the U.S. International Trade Administration revoked the antidumping duty that in 1997 had been imposed on steel concrete-reinforcing bar (rebar) from Turkey. The effective date of the revocation was March 28, 2008 (U.S. International Trade Administration, 2009).

Iron Ore.—In 2008, Hekimhan Madencilik İthalat İhracat San. ve Tic. A.Ş., which was a subsidiary of Kolin İnşaat Turizm San. ve Tic. A.Ş., proposed to install a calcination plant that by 2011 would produce about 1 million metric tons per year (Mt/yr) of calcined siderite sintering dust from 2 Mt/yr of ore. Tests indicated that the iron content of siderite ore from Hekimhan's iron ore mine near Deveci, Malatya Province, could be raised to 56% from 38% after calcination (Hekimhan Madencilik İthalat İhracat San. ve Tic. A.Ş., 2008).

Nickel.—The dramatic decline in nickel prices during the last three quarters of 2008 resulted in the significant slump in nickel exploration activity in Turkey. Aldridge Minerals suspended work on its Murat Dag nickel laterite project and the joint venture of Lydian International Ltd. and Newmont Overseas Exploration Ltd. decided to seek a partner to develop its Muratdag gold-nickel prospect (Aldridge Minerals Inc., 2009, p. 3; London Metal Exchange Ltd., undated).

Industrial Minerals

Boron.—In 2008, Eti Maden İşletmeleri Genel Müdürlüğü expanded operations with the startup of a 45,000-t/yr capacity expansion of the borax decahydrate plant as well as the startup of a 5,000-t/yr-capacity boron oxide plant at Badirma and an anhydrous borax plant at Kirka (Eti Maden İşletmeleri Genel Müdürlüğü, 2009, p. 59-61).

Soda Ash.—Eti Soda Inc., which was a subsidiary of the Ciner Group and Eti Maden, continued construction work on the 1-Mt/yr-capacity soda ash plant at Beypazari. Initial production was scheduled to begin in early 2009, and the plant was expected to reach full production by mid-year. The plant also had the capacity to produce 100,000 t/yr of sodium bicarbonate (Ciner Group, 2009; Eti Maden İşletmeleri Genel Müdürlüğü, 2009, p. 72).

Rio Tinto completed a prefeasibility study of the Kazan trona (soda ash) project in 2008. Rio Tinto's planned trial mining of the soda ash deposit was cancelled when the company decided to withdraw from the soda ash sector and to sell the project (Rio Tinto Group, 2009, p. 64).

Mineral Fuels and Related Materials

Uranium.—In early 2008, Aldridge Minerals Inc. of Canada acquired mineral licenses for properties that had the potential for uranium mineralization. At yearend, ownership of the uranium properties was transferred to Aldridge Uranium Inc., which was a newly-formed company owned by Aldridge Minerals shareholders (Aldridge Minerals Inc., 2009, p. 3-4).

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Outlook

Turkey has significant resources of bentonite, boron, lignite, marble, and perlite. Although Turkey has numerous other mineral deposits, most international investor interest is focused on the development of high-value minerals, such as gold (Ersçen, 1989).

Administrative and legal difficulties, such as those that resulted in the former suspension of operations at the Ovacik gold mine; the unexpected delay of permission to construct the Çaldağ nickel mine's heap leach pads and processing plant; and the legal proceedings to cancel previously issued environmental certificates for the Efemcukuru gold development project and the Kişladag Mine and to cancel the licenses for the Cerattepe copper and zinc project, could adversely influence investment decisions concerning mineral development projects in Turkey.

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TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008[e]
METALS						
Aluminum		60,000	60,000 [e]	60,000 [e]	65,000 [e]	65,000
Antimony:[e]						
Ore, mine output:						
Gross weight		20,107 [2]	28,000	25,000	28,000	30,000
Sb content		900	1,400	1,250	1,400	1,500
Concentrates:						
Gross weight		3,000	5,000	4,500	5,000	5,300
Sb content		700	1,200	1,100	1,200	1,300
Bauxite and alumina						
Bauxite		365,836	475,349	771,227	343,564 [r]	350,000
Alumina, gross weight		169,991	112,558	150,117	163,455	160,000
Chromium, gross weight (34% to 43% chromic oxide)[3]		506,421	688,377	1,059,900 [r]	1,678,900 [r]	1,885,700 [2]
Copper:						
Mine output, exclusive of pyrite:[4]						
Gross weight		2,356,147	2,946,106	2,500,000 [e]	4,000,000 [e]	4,100,000
Cu content of ore[e]		49,000	54,000	46,000	81,000 [r]	83,000
Metal:[e]						
Smelter output, primary and secondary		34,700 [2]	27,600	30,000	30,000	30,000
Refined		64,000	95,000	106,000	100,000 [r]	90,000
Gold[e, 5]	kilograms	3,260	4,170	8,040	9,920	11,100
Iron and steel:						
Iron ore:						
Gross weight	thousand metric tons	4,120	4,598	3,785	4,849	3,990
Fe content[e]	do.	2,200	2,450	2,000	2,600	2,100
Metal:						
Pig iron and ferroalloys:						
Cast iron[6]		213,210	178,395	121,956	264,808	250,000
Crude (pig) iron		5,835,889	6,371,084	5,952,106	6,235,537	6,697,000 [2]
Ferrochromium		28,701	26,043	67,975	69,730	40,000
Ferrosilicon[e]		--	4,000	2,000	5,000	5,000
Steel, crude including castings	thousand metric tons	20,478	20,960	23,300 [e]	25,760 [r]	26,809 [2]
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight		407,637	366,308	279,727	684,931	700,000
Pb content		18,650	17,000	13,000	32,000	33,000
Concentrates:[e]						
Gross weight		26,000	29,000	23,000	55,000	56,000
Pb content		17,000	15,500	12,000	20,000 [r]	20,000
Metal, refined[e]		6,000	6,000	6,000	6,000	6,000
Manganese ore, gross weight[7]		21,204	52,273	32,144	42,033	40,000
Mercury		--	--	--	65	60
Molybdenum, ore, gross weight		--	--	--	185	200
Nickel, mine output, Ni content[e]		40	1,000	1,500	--	--
Silver, mine output, Ag content[8]	kilograms	97,000	137,560	167,340	198,000 [2]	180,000
Zinc:[e]						
Mine output, Zn and Cu-Zn ore:						
Gross weight	thousand metric tons	765 [2]	1,000	1,500	1,800	1,800
Zn content	do.	38	41	69	80	80
Concentrates:						
Gross weight		90,000	96,000	160,000	188,000	188,000
Zn content		33,400	36,000	60,000	70,000	70,000
INDUSTRIAL MINERALS						
Aluminum sulfate, alunite		--	--	6,683	2,511	2,500
Barite, crude		134,504	157,179	161,993	184,041	170,000
Boron minerals:						
Run of mine		2,878,930	3,478,784	3,955,574	4,406,970	4,897,869 [2]
Concentrates		1,587,992	1,824,571	1,818,944	2,127,812	2,139,224 [2]
Refined borates		714,538	923,253	1,021,139	1,092,056	1,000,000

See footnotes at end of table.

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TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008[e]
INDUSTRIAL MINERALS—Continued						
Cement, hydraulic	thousand metric tons	38,796	42,787	47,977	49,553 [r]	51,432
Clays:						
Bentonite		1,281,468	501,142	1,134,251	1,742,487	1,600,000
Kaolin		536,008	908,862	1,064,107	914,117	900,000
Other		3,626,625	1,962,072	3,034,560	2,871,145	2,900,000
Diatomite		1,324	44,122	45,420	33,135	30,000
Emery		7,902	9,378	13,899	19,108	19,000
Feldspar, run of mine		1,983,336	2,331,971	5,771,892	6,548,796	6,500,000
Glass, crude	thousand metric tons	1,229	1,058	1,600 [e]	1,900 [e]	1,900
Graphite, run of mine[e]		1,000	100	300	400	400
Gypsum		2,300,703	3,500,864	4,369,771	3,241,177	3,000,000
Lime[e, 9]	thousand metric tons	3,400	3,400	3,600	3,600	3,600
Magnesium, magnesite, run of mine		3,732,952	2,372,206	2,088,033	2,100,000 [e]	2,100,000
Mica:						
Illite		--	--	27,898	57,774	55,000
Other		321	3,584	--	3,313	3,000
Nitrogen, N content of ammonia		329,444	304,617	91,665	--	50,000
Olivine		71,396	94,439	191,298	145,839	150,000
Peat		62,108	71,749	185,944	145,403	150,000
Perlite, run of mine		133,829	156,935	260,000 [e]	270,000 [e]	270,000
Pumice		1,035,975	1,860,037	3,515,644	3,995,423	4,000,000
Pyrites, cupreous, gross weight		765,432	800,000 [e]	900,000 [e]	900,000 [e]	900,000
Sepiolite, meerschaum[e]	kilograms	150	170	130	50	50
Silica sand, gross weight		2,073,725	1,729,525	2,608,260	4,997,694	5,000,000
Sodium compounds:						
Salt, NaCl, all types	thousand metric tons	2,158	2,253	2,800 [e]	1,500 [e]	1,500
Soda ash, trona	do.	846	869	891	947	950
Sodium sulfate, concentrates		523,285	809,187	226,014	1,120,968	1,100,000
Stone:						
Dolomite		2,109,362	10,636,615	14,621,691	15,672,171	15,000,000
Granite		125,030	160,930	320,069	252,354	250,000
Limestone, other than for cement	thousand metric tons	30,963	12,271	5,876	7,171	7,200
Marble	cubic meters	668,996	1,578,730	1,855,740	2,801,757	2,800,000
Onyx	do.	57	451	2,578	5,663	5,700
Quartz and quartzite		16,765,177	1,466,533	1,871,887	2,146,969	2,100,000
Travertine	cubic meters	601,068	696,545	1,017,672	995,065	1,000,000
Strontium minerals, celestite:[e]						
Run of mine		127,947 [2]	30,100 [2]	10,500	6,700	2,600
Concentrates		77,000	18,000	6,300	4,200	1,600
Sulfur:[e]						
Byproduct:						
Petroleum		49,000 [2]	54,000 [2]	69,000	86,000	86,000
Other		19,000	20,000	20,000	20,000	20,000
S content of pyrites		20,000	20,000	20,000	20,000	20,000
Total		88,000	94,000	109,000	126,000	126,000
Talc		8,233	8,775	4,969	12,722	12,000
Titanium minerals, rutile, gross weight		4,900	12 [e]	--	20	20
Zeolite		192,240	249,572	121,014	104,138	100,000
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural		738,915	905,838 [r]	474,523 [r]	781,649 [r]	750,000
Carbon black		32,686	26,820	51,788	40,379	40,000
Coal:						
Hard coal, run of mine	thousand metric tons	2,843	3,050	3,071	3,233	3,343 [2]
Lignite, run of mine	do.	43,754	55,626	61,006	70,606	85,953 [2]
Coke and semicoke	do.	2,855	2,800 [e]	3,261	3,337	4,063 [2]
Gas, natural, marketed	thousand cubic meters	344,196	483,525	306,136	287,501	300,000

See footnotes at end of table.

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TABLE 1—Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2004	2005	2006	2007	2008[e]
MINERAL FUELS AND RELATED MATERIALS—Continued						
Petroleum:						
Crude	thousand 42-gallon barrels	16,270	16,500 [e]	15,300	15,000 [e]	14,700
Refinery products:[e]						
Liquefied petroleum gas	do.	8,340 [3]	8,900	9,300	8,800	8,900
Gasoline	do.	27,350 [3]	30,300	30,800	33,900	37,700
Naphtha	do.	12,700 [3]	11,500	11,500	7,200	4,600
Jet fuel and Kerosene	do.	14,340 [3]	15,924	17,100	20,500	22,400
Distillate fuel oil[10]	do.	53,660 [3]	56,400	56,800	53,000	49,000
Lubricants	do.	2,050 [3]	2,400	2,300	2,100	1,800
Residual fuel oil	do.	40,270 [3]	42,100	38,600	36,200	31,700
Asphalt	do.	8,430 [3]	10,700	13,400	13,900	13,600
Unspecified[11]	do.	3,610 [3]	1,050	5,300	5,300	2,500
Total	do.	170,750 [3]	179,000	185,000	181,000	172,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto. -- Zero.

[1]Table includes data available through February 17, 2010. In addition to the commodities listed, large quantities of construction materials (clay, and sand and gravel) are quarried. Also mined are basalt, diabase, sandstone, serpentine, and slate for building stone; gypsum and limestone for cement manufacture; and garnet, iron oxide pigment, and tungsten, but available information is inadequate to make estimates of output.

[2]Reported figure.

[3]Approximately 70% of gross production is salable product.

[4]Copper mines produce a copper concentrate (of about 22% Cu) and a cupreous pyrite concentrate (of about 0.7% Cu). Copper is not recovered from the cupreous pyrite concentrate.

[5]Data include estimated content of Turkish copper refinery tankhouse slimes.

[6]Series formerly carried as pig iron.

[7]Does not include manganiferous iron ore from the Deveci Mine, production of which amounts to several hundred thousand metric tons per year and has a manganese content of between 3% and 5%.

[8]Includes estimated content of base-metals-refinery tankhouse slimes.

[9]Estimated sales only.

[10]Diesel fuel (gasoil) and special heating oil.

[11]Includes refinery fuel and losses.

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TABLE 2
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum, metal	Eti Alüminyum A.Ş. (Cengiz Holding)	Smelter at Seydisehir, Konya Province	65
Bauxite and alumina:			
Alumina	do.	Refinery at Seydisehir, Konya Province	200
Bauxite	do.	Mines near Madenli, about 25 kilometers south of Seydisehir, Konya Province	500
Do.	Albuck Madencilik San. ve Tic. A.Ş.	Mine near Cırpı, Mugla Province	NA
Do.	do.	Mine near Mihalıccık, Eskisehir Province	NA
Boron:			
Concentrate and ground ore	Bigadiç Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Three open pit mines at Bigadic, Balikesir Province	650
Do.	Emet Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Espey Mine, Emet, Kutahya Province	500
Do.	do.	Hisarcik Mine, Emet, Kutahya Province	500
Do.	Kestelek Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Kestelek Mine, Bursa Province	100
Do.	Kırka Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Mine at Kırka, Eskisehir Province	800
Refined borates	Bandırma Bor ve Asit Fabrikalari İşletme Müdürlüğü, (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Plant at Bandırma, Balikesir Province	100
Do.	Emet Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Boric acid plant, Emet, Kutahya Province	100
Do.	Kırka Bor İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Plant at Kırka, Eskisehir Province	600
Cement:			
Gray portland	Adana Çimento Sanayii ve Ticaret A.Ş. (Ordu Yardımlaşma Kurumu (OYAK) Çimento Grubu, 57%)	Adana, Adana Province	3,400
Do.	do.	Iskenderun grinding plant, Iskenderun, Hatay Province	1,000
Do.	Afyon Çimento Sanayii Ticaret A.Ş. (Ciments Français S.A., 77%)	Afyon, Afyon Province	550
Do.	Akçansa Çimento Sanayi ve Ticaret A.Ş. (HeidelbergCement AG, 40%, and Sabancı Holding A.Ş., 40%)	Buyukcekmece plant, Buyukcekmece, Istanbul Province	2,800
Do.	do.	Canakkale plant, about 11 kilometers northwest of Ezine, Canakkale Province	3,500
Do.	do.	Ladik plant, Ladik, Samsun Province	1,050
Do.	AS Çimento Sanayi ve Ticaret A.Ş.	Bucak, Burdur Province	6,500
Do.	Aşkale Çimento Sanayi ve Ticaret A.Ş.	Trabzon plant, Degirmendere, Trabzon Province	800
Do.	do.	Askale, Erzurum Province	720
Do.	Bakırçay Çimento Sanayii ve Ticaret A.Ş. (Kars Çimento San. ve Tic. A.Ş., 98%)	Poyracık, near Kınık, Izmir Province	12
Do.	Bartın Çimento Sanayii ve Ticaret A.Ş. (Sanko Holding A.Ş.)	Bartin plant, Bartin Province	400
Do.	Baştaş Çimento Sanayii A.Ş. (Vicat Group, 85%)	Elmadag, Ankara Province	1,500
Do.	Batıçim Batı Anadolu Çimento Sanayii A.Ş. (Orascom Construction Industries, 23%)	Bornova, İzmir Province	1,600
Do.	Batısöke Söke Çimento Sanayii ve Ticaret A.Ş. (Batıçim Batı Anadolu Çimento Sanayii A.Ş., 75%)	Soke, Aydin Province	1,300
Do.	Bolu Çimento Sanayii A.Ş. (Ordu Yardımlaşma Kurumu (OYAK) Çimento Grubu, 52%)	About 14 kilometers east of Bolu, Bolu Province	2,200
Do.	do.	Ankara grinding plant, Kazan, Ankara Province	800
Do.	Bursa Çimento Sanayii ve Ticaret A.Ş. (Bursa Çimento Fabrikası A.Ş., 98%)	Kestel, Bursa Province	2,850
Do.	Çimentaş İzmir Çimento Fabrikası Türk A.Ş. (Intercem SA, 67%, and Cementir Holding SpA, 29%)	Isıkkent, Izmir Province	2,600
Do.	do.	Trakya plant, Lalapasa, Edirne Province	1,300
Do.	Çimko Adıyaman Çimento ve Beton Sanayii ve Ticaret A.Ş. (Çimko Çimento ve Beton Sanayii Ticaret A.Ş.)	About 18 kilometers southwest of Adiyaman, Adiyaman Province	1,350

See footnotes at end of table.

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TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement—Continued:			
Gray portland—Continued	Çimko Çimento Kahramanmaraş Narlı Fabrikası (Çimko Çimento ve Beton Sanayii Ticaret A.Ş.)	Narlı plant, Narli, Kahramanmaras Province	3,300
Do.	Cimpor Yibitaş Çimento Sanayii ve Ticaret A.Ş. (Cimpor Internacional, SGPS, S.A., 99%)	Corum plant, Corum, Corum Province	950
Do.	do.	Hasanoglan grinding plant, Hasanoglan, Hasanoglan Province	725
Do.	do.	Nevşehir grinding plant, Kalaba, Nevsehir Province	300 e
Do.	do.	Samsun grinding plant, about 6 kilometers west of Samsun, Samsum Province	300 e
Do.	do.	Sivas plant, Sivas, Sivas Province	615
Do.	do.	Yozgat plant, Saraykoy, Yozgat Province	800
Do.	Çimsa Çimento Sanayii ve Ticaret A.Ş. (Sabancı Holding A.Ş., 47%)	Ankara grinding plant, Lalahan, Ankara Province	230
Do.	do.	About 20 kilometers northwest of Eskisehir, Eskisehir Province	1,800
Do.	do.	Near Agirnas, Kayseri Province	1,000
Do.	do.	Mersin plant, Yenitaskent, Mersin Province	2,300
Do.	do.	Nigde plant, Nigde, Nigde Province	1,200
Do.	Denizli Çimento Sanayi ve Ticaret A.Ş. (CRH plc, 50%, and Eren Holding A.S., 50%)	About 5 kilometers northwest of Kaklik, Denizli Province	2,500
Do.	Elazığ Çimento A.Ş. (Kars Çimento Sanayii ve Ticaret A.Ş., 93.55%; Cimentas A.Ş., 6.17%; Bakırçay Çimento Sanayii ve Ticaret A.Ş., 0.27%)	Elazıg, Elazıg Province	900
Do.	Göltaş Göller Bölgesi Çimento Sanayii ve Ticaret A.Ş. (Sadecib S.A., 34%, and Göl Yatırım Holding A.Ş, 28%)	About 15 kilometers north-northwest of Isparta, Isparta Province	2,900
Do.	Kars Çimento Sanayii ve Ticaret A.Ş. (Cimentas A.Ş., 58%, and Alfacem Srl, 40%)	Bozkale, Kars Province	600
Do.	Konya Çimento Sanayii A.Ş. (Vicat Group, 81%)	Konya, Konya Province	1,600
Do.	Lafarge Aslan Çimento A.Ş. (Financiere Lafarge S.A., 97%)	Darica plant, Gebze, Kocaeli Province	2,880
Do.	Lafarge Ereğli Çimento Sanayii ve Ticaret A.Ş. (Lafarge Aslan Çimento A.Ş., 50%)	Karadeniz Eregli plant, Kemer, Zonguldak Province	300
Do.	Lafarge Van Çimento A.Ş. (Lafarge S.A., 99.99%)	Edremit, Van Province	600
Do.	Limak Kurtalan Çimento Sanayii ve Ticaret A.Ş. (Limak Şirketler Grubu)	Sanlıurfa plant, about 14 kilometers north-northwest of Sanliurfa, Sanliurfa Province	1,400
Do.	do.	Gaziantep plant, Gaziantep (Sehit Kamil), Gaziantep Province	1,400
Do.	do.	Kurtalan plant, Kurtalan, Siirt Province	1,140
Do.	Limak Madencilik Yapı Çimento Sanayii ve Ticaret A.Ş. (Limak Şirketler Grubu)	Ergani plant, Ergani, Diybakir Province	1,400
Do.	Limak - Istaç Inşaat Sanayi ve Ticaret A.Ş.	Bitlis plant, Bitlis Province	525
Do.	Mardin Çimento Sanayii ve Ticaret A.Ş. (Ordu Yardımlaşma Kurumu (OYAK) Çimento Grubu, 56%)	About 6 kilometers northeast of Mardin, Mardin Province	2,000
Do.	Nuh Çimento Sanayi A.Ş. (Nuh Ticaret ve Sanayi A.Ş., 43%)	Hereke, Kocaeli Province	5,817
Do.	Set Çimento Sanayi ve Ticaret A.Ş. (Set Çimento Group)	Ambarli grinding plant, Buyukcekmece, Istanbul Province	1,200
Do.	do.	Ankara plant, Ankara, Ankara Province	1,300
Do.	do.	Trakya plant, Pinarhisar, Kirklareli Province	800
Do.	do.	Balikesir, Balikesir Province	500
Do.	Traçim Çimento Sanayii ve Ticaret A.Ş. (Soyak Holding A.Ş. and TBS Taşıma Beton A.Ş).	Evrencik, Vise, Kirklareli Province	2,000
Do.	Ünye Çimento Sanayi ve Ticaret A.Ş. (Ordu Yardımlaşma Kurumu (OYAK) Çimento Grubu, 51%, and Nuh Çimento Sanayi A.Ş., 39%)	Unye, Ordu Province	2,600
Slag	KarÇimsa Çimento Sanayii ve Ticaret A.Ş. (Akçansa Çimento Sanayi ve Ticaret A.Ş.)	Karabuk, Karabuk Province	200
White	Adana Çimento Sanayii ve Ticaret A.Ş. (Ordu Yardımlaşma Kurumu (OYAK) Çimento Grubu, 57%)	Adana, Adana Province	325
Do.	Çimsa Çimento Sanayii ve Ticaret A.Ş. (Sabancı Holding A.Ş., 47%)	Mersin plant, Yenitaskent, Mersin Province	1,000 e

See footnotes at end of table.

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TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal:			
Anthracite	Armutçuk Taskömürü Isletme Müessesesi [Türkiye Taşkömürü Kurumu Genel Müdürlüğü (T.T.K.)] (Government)	Armutcuk Mine, Armutcuk, Eregli Province	400
Do.	Amasra Taskömürü Isletme Müessesesi [Türkiye Taşkömürü Kurumu Genel Müdürlüğü (T.T.K.)] (Government)	Amasra Mine, Amasra, Bartın Province	300
Do.	Karadon Taskömürü Isletme Müessesesi [Türkiye Taşkömürü Kurumu Genel Müdürlüğü (T.T.K.)] (Government)	Karadon Mine, Kilimli, Zonguldak Province	450
Do.	Kozllu Taskömürü Isletme Müessesesi [Türkiye Taşkömürü Kurumu Genel Müdürlüğü (T.T.K.)] (Government)	Kozlu Mine, Kozlu, Zonguldak Province	600
Do.	Üzülmez Taskömürü Isletme Müessesesi [Türkiye Taşkömürü Kurumu Genel Müdürlüğü (T.T.K.)] (Government)	Uzulmez Mine, Asma, Zonguldak Province	500
Lignite[1]	Bursa Linyitleri İşletmesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Bursa lignite facility, Orhaneli, Bursa Province	1,000
Do.	Çan Linyitleri İşletmesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Can lignite facility, Can, Canakkale Province	1,800
Do.	Ege Linyitleri İşletmesi Müessesesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Soma Mine, Soma, Manisa Province	10,500
Do.	Garp Linyitleri İşletmesi Müessesesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Tuncbilek mining center, Tavsanlı, Kutahya Province	7,000
Do.	Güney Ege Linyitleri İşletmesi Müessesesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	South Aegean lignite facility, Yatagan, Mugla Province	4,900
Do.	Ilgın Linyitleri İşletmesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Ilgin lignite facility, Ilgın, Konya Province	300
Do.	Seyitömer Linyitleri İşletmesi Müessesesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Seyitomer lignite facility, Seyitomer, Kutahya Province	8,000
Do.	Yeniköy Linyitleri İşletmesi Müdürlüğü [Türkiye Kömür İşletmeleri Kurumu (TKI)] (Government)	Yenikoy lignite facility, Oren (Milas), Mugla Province	8,500
Copper:			
Concentrate, Cu content	Çayeli Bakir İşletmeleri A.Ş. (Inmet Mining Corp., 100%)	Cayeli Mine, near Cayeli, Rize Province	37
Do.	Eti Bakir A.Ş. (Cengiz Holding, 100%)	Kastamonu Kure facility (three open pit and one underground mines), 50 kilometers north of Kastamonu, Kastamonu Province	23
Do.	do.	Murgul facility (three open pit mines, including the Anayatak and the Çakmakkaya Mines), Murgul, Artvin Province	20
Anode	Karadeniz Bakır İşletmeleri (Cengiz Holding)	KBI smelter, Tekkekoy, Samsun Province	38
Ferrochrome, high-carbon	Eti Krom A.Ş. (Yildrim Holding A.Ş.)	About 55 kilometers east of Elazıg, Elazıg Province	150
Fertilizer:			
Ammonium nitrate	Kütahya Gübre Sanayii A.Ş. (Yildiz Yatirim Holding A.Ş.)	Kutahya, Kütahya Province	344
Diammonium phosphate	Samsun Gübre Fabrikası [Türkiye Gübre Sanayii A.Ş. (TÜGSAŞ)]	Tekkekoy, Samsun Province	227
Do.	Ege Gübre Sanayii A.Ş.	Aliaga, İzmir Province	165
Do.	Istanbul Gubre Sanayi A.Ş. (IGSAŞ), (Yildiz Yatirim Holding A.Ş.)	Korfez, Kocaeli Province	240
Mono-ammonium phosphate	Ege Gübre Sanayii A.Ş.	Aliaga, İzmir Province	130
Gold, ore, kilograms Au content	Koza Altın İşletmeleri A.Ş.	Ovacık Mine, Ovacık, Mugla Province	6,000
Do. do.	do.	Mastra Mine, near Demirkaynak, Gumushane Province	5,000
Do. do.	do.	Havran Mine, Balikesir Province	3,000
Do. do.	Tüprag Metal Madencilik Sanayi ve Ticaret A.Ş. (Eldorado Gold Corp., 100%)	Kisladag Mine, Katrancı, Usak Province	7,500
Iron and steel:			
Iron ore	Erdemir Madencilik Sanayi ve Ticaret A.Ş. (Ereğli Demir ve Çelik Fabrikalari T.A.Ş.) (Erdemir)	Fourteen mines in the Divrigi area, Sivas Province	2,500
Do.	Hekimhan Madencilik İthalat İhracat Sanayi ve Ticaret A.Ş. (Kolin İnşaat Turizm Sanayi ve Ticaret A.Ş.)	About 22 kilometers northeast of Hekimhan (formerly the Deveci Mine), Malatya Province	2,000 [2]

See footnotes at end of table.

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TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel—Continued:			
Steel:			
Crude	Asil Çelik A.Ş.	Plant south of Orhangazi, Bursa Province	485
Do.	Bilecik Demir Çelik Sanayi ve Ticaret A.Ş. (Global Yatırım Holding A.Ş., 40%)	Bilecik, Bilecik Province	240
Do.	Çebitaş Demir Çelik Endüstrisi A.Ş.	Aliaga, İzmir Province	700
Do.	Çelik Makina Sanayi ve Ticaret A.Ş. (ÇEMTAŞ)	Bursa, Bursa Province	155
Do.	CER Çelik Endüstrisi A.Ş.	Plant at Bornova, Izmir Province	850
Do.	Çolakoğlu Metalurji A.Ş.	Dilovası, Kocaeli Province	3,000
Do.	Diler Demir Çelik Endüstrisi ve Ticaret A.Ş.	do.	1,200
Do.	Ege Çelik Endüstrisi Sanayi ve Ticaret A.Ş.	Aliaga, İzmir Province	2,000
Do.	Ekinciler Holding A.Ş.	About 10 kilometers north of İskenderun, Hatay Province	1,000
Do.	Erege Metal Demir Çelik Sanayi ve Ticaret A.Ş.	Aliaga, Izmir Province	720
Do.	Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir) (Ataer Holding A.Ş., 49.29%, and ArcelorMittal, 24.99%)	Karadeniz Ereğli, Zonguldak Province	3,400
Do.	Habaş Sinai ve Tibbi Gazlar Istihsal Endustrisi A.S. (Habaş Topluluğu)	Aliaga, Izmir Province	3,000
Do.	İçdaş Demir Çelik Enerji Tersane ve Ulaşım Sanayi A.Ş.	İstanbul (Gunesli), Istanbul Province	1,000
Do.	do.	About 25 kilometers north of Biga, Canakkale Province	1,500
Do.	İlhan Metalurji A.Ş.	Toprakkale, Osmaniye Province	220
Do.	İskenderun Demir ve Çelik A.Ş. (Isdemir) [Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir), 92%]	İskenderun, Hatay Province	2,850
Do.	İzmir Demir Çelik Sanayi A.Ş. (IDÇ)	Aliaga, Izmir Province	1,320
Do.	Kaptan Demir Çelik Endüstrisi ve Ticaret A.Ş.	Marmara Ereglisi, Tekirdag Province	1,400
Do.	Karabük Demir Çelik Sanayi ve Ticaret A.Ş. (Kardemir) (Kardemir retirement group, 68%, and Kardemir employees, 21%)	Karabuk, Karabuk Province	1,450
Do.	Kroman Çelik Sanayii A.Ş.	Cayırova, Kocaeli Province	1,250
Do.	Makina ve Kimya Endüstrisi Kurumu Genel Müdürlüğü (MKEK)	Kırıkkale, Kırıkkale Province	60
Do.	Mega Demir Mamulleri Sanayi ve Ticaret Ltd. ŞTI	North of İskenderun, Hatay Province	220
Do.	Nursan Metalurji A.Ş	Payas, Hatay Province	1,100
Do.	Sivas Demir Çelik İşletmeleri A.Ş (Sidemir)	About 20 kilometers south of Sivas, Sivas Province	350
Do.	Yazıcı Demir Çelik Endüstrisi ve Ticaret A.Ş. (Diler Demir Çelik Endüstrisi ve Ticaret A.Ş.)	Karabuk, Karabuk Province	900
Do.	Yeşilyurt Demir Çelik A.Ş.	Tekkeköy, Samsun Province	1,300
Rolled products	Asil Çelik A.Ş.	Rolling mill south of Orhangazi, Bursa Province	200
Do.	Borçelik Çelik Sanayii ve Ticaret A.Ş. (ArcelorMittal and Borusan Holding A.Ş.)	Near Gemlik, Bursa Province	1,600
Do.	Çebitaş Demir Çelik Endüstrisi A.Ş.;	Aliaga, Izmir Province	600
Do.	Çelik Makina Sanayi ve Ticaret A.Ş. (ÇEMTAŞ)	Bursa, Bursa Province	230
Do.	CER Çelik Endüstrisi AŞ	Rolling mill at Bornova, Izmir Province	300
Do.	Çolakoğlu Metalurji A.Ş.	Dilovası, Kocaeli Province	750
Do.	Demirsan Haddecilik Sanayi ve Ticaret A.Ş.	do.	NA
Do.	Diler Demir Çelik Endüstrisi ve Ticaret A.Ş.	do.	800
Do.	Ege Çelik Endüstrisi Sanayi ve Ticaret A.Ş.	Aliaga, Izmir Province	1,200
Do.	Ekinciler Holding A.Ş.	About 10 kilometers north of İskenderun, Hatay Province	1,100
Do.	Erege Metal Demir Çelik Sanayi ve Ticaret A.Ş.	Aliaga, İzmir Province	400
Do.	Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir) (Ataer Holding A.Ş., 49.29%, and ArcelorMittal, 24.99%)	Karadeniz Eregli, Zonguldak Province	8,800
Do.	Habaş Sinai ve Tibbi Gazlar Istihsal Endustrisi A.S. (Habaş Topluluğu)	Aliaga, Izmir Province	NA
Do.	İçdaş Demir Çelik Enerji Tersane ve Ulaşım Sanayi A.Ş.	İstanbul (Gunesli), Istanbul Province	1,500
Do.	do.	About 25 kilometers north of Biga, Canakkale Province	1,500
Do.	Intermet A.S.Ş.	2 rolling mills, Istanbul, Istanbul Province	600
Do.	İskenderun Demir ve Çelik A.Ş. (Isdemir) [Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir), 92%]	İskenderun, Hatay Province	3,500

See footnotes at end of table.

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TABLE 2—Continued
TURKEY: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel—Continued:				
Steel—Continued:				
Rolled products—Continued		İzmir Demir Çelik Sanayi A.Ş. - (IDÇ)	Aliaga, Izmir Province	900
Do.		Kaptan Demir Çelik Endüstrisi ve Ticaret A.Ş.	Marmara Ereglisi, Tekirdag Province	700
Do.		do.	Corlu, Tekirdag Province	200
Do.		do.	Karabuk, Karabuk Province	100
Do.		Karabük Demir Çelik Sanayi ve Ticaret A.Ş. (Kardemir) (Kardemir retirement group, 68%, and Kardemir employees, 21%)	do.	700
Do.		Kar-demir Haddecilik Sanayi ve Ticaret Ltd. ŞTI	Aliaga, Izmir Province	700
Do.		Kocaer Haddecilik Sanayi ve Ticaret Ltd. ŞTI. (Kocaer Grubu)	do.	600
Do.		do.	Denizli, Denizli Province	100
Do.		Kroman Çelik Sanayii A.Ş.	Bar and profile mill at Cayırova, Kocaeli Province	200
Do.		Kürüm Demir Sanayi Dış Ticaret A.Ş.	Gebze, Kocaeli Province	445
Do.		Nursan Haddecilik A.Ş	Payas, Hatay Province	500
Do.		Özefe Demir Sanayi ve Tic A.Ş. (Efesan Demir Sanayi ve Ticaret A.Ş.)	Bar mills at Alibeykoy, İstanbul Province	250
Do.		Özkan Demir Sanayi A.Ş.	Aliaga, Izmir Province	500
Do.		Sivas Demir Çelik İşletmeleri A.Ş (Sidemir)	About 20 kilometers south of Sivas, Sivas Province	450
Do.		Sözer Demir Çelik A.Ş.	Aliaga, İzmir Province	220
Do.		Yazıcı Demir Çelik Endüstrisi ve Ticaret A.Ş. (Diler Demir Çelik Endüstrisi ve Ticaret A.Ş.)	Karabuk, Karabuk Province	1,024
Do.		Yeşilyurt Demir Çelik A.Ş.	Tekkekoy, Samsun Province	720
Liquefied natural gas	million cubic meters	Boru Hatları İle Petrol Taşıma A.Ş. (Botaş) (Government)	Botas Marmara Ereglisi re-gasification terminal, Sultankoy, Tekirdag Province	6,500
Do.	do.	EgeGas LNG (Çolakoğlu Group, 100%)	Aliaga re-gasification terminal, Aliaga, Izmir Province	6,000
Magnesite, dead-burned		Kümaş Kütahya Manyezit İşletmeleri A.Ş. (Zeytinoğlu Holding A.Ş.)	Kutahya, Kutahya Province	185
Nickel, ore, metal content		Sardes Nikel Madencilik A.Ş. (European Nickel PLC)	Caldag Mine, about 25 kilometers north of Turgutlu, Manisa Province	20
Nitrogen, N content of ammonia		Istanbul Gubre Sanayi A.Ş. (IGSAŞ) (Yildiz Yatirim Holding A.Ş.)	Korfez, Kocaeli Province	326
Do.		Gemlik Gübre Sanayii A.Ş. [Türkiye Gübre Sanayii A.Ş. (TÜGSAŞ)]	Gemlik, Bursa Province	270
Petroleum, refined products	thousand 42-gallon barrels per day	Türkiye Petrol Rafinerileri A. Ş. (Tüpras) (Enerji Yatirimlari A.S., 51%)	Izmir refinery, Aliaga, İzmir Province	78,650
Do.	do.	do.	Izmit refinery, Izmit, Kocaeli Province	78,650
Do.	do.	do.	Kırıkkale refinery, Kırıkkale, Kırıkkale Province	55,000
Do.	do.	do.	Batman refinery, Batman, Batman Province	12,100
Do.	do.	Ersan Petrol Sanayii A.Ş (Sayer Group, 100%)	Narli refinery, Narli, Kahramanmaras Province	1,330 [3]
Silver, ore	metric tons	Eti Gümüş A.Ş. (Yıldızlar SSS Holding)	Gumuskoy, Kutahya Province	198
Soda ash		Eti Soda Inc. [Ciner Grubu, 74%, and Eti Maden İşletmeleri Genel Müdürlüğü (Government), 26%)]	Beypazarı trona mine and soda ash plant, Beypazari, Ankara Province	1,000 [4]
Do.		Soda Sanayii A.Ş [Türkiye Şişe ve Cam Fabrikaları A.Ş. (ŞİŞECAM)]	Kazanlı, Mersin Province	950
Sulfur		Türkiye Petrol Rafinerileri A. Ş. (Tüpras) (Enerji Yatirimlari A.S., 51%)	Izmir refinery. Aliaga, Izmir Province	NA
Do.		do.	Izmit refinery Izmit, Kocaeli Province	NA
Do.		do.	Kirikkale refinery, Kirikkale, Kirikkale Province	NA
Sulfuric acid		Bandırma Bor ve Asit Fabrikalari İşletme Müdürlüğü (Eti Maden İşletmeleri Genel Müdürlüğü) (Government)	Plant at Bandırma, Balıkesir Province	240

[e]Estimated. Do., do. Ditto. NA Not available.
[1]Includes subbituminous coal.
[2]Planned expansion by 2011.
[3]Inactive
[4]Under construction.

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The Mineral Industry of the United Arab Emirates

By Mowafa Taib

The United Arab Emirates (UAE)[1] was one of the world's top producers of crude oil and accounted for 3.6% of world crude oil production in 2008. The UAE held 97.8 billion barrels of proven crude oil reserves, which was about 7.8% of the world's total, and ranked seventh in the world in terms of the size of its proved crude oil reserves. The UAE was responsible for 1.6% of the world's supply of natural gas; it held 6.43 trillion cubic meters of proved natural gas reserves, or 3.5% of the world's total, and was ranked seventh in the world in terms of the size of its proved natural gas reserves. The UAE was a major supplier of aluminum foundry alloy, extrusion billet, and high-purity aluminum to 300 clients in 48 countries. It produced about 2.3% of the world's smelter output and held about 2.1% of the world's aluminum production capacity at yearend 2008. The UAE was a significant importer of minerals in 2008; it was the world's leading importer of rebar and accounted for 27.3% of world imports (Arab Steel, 2009; Bray, 2009, p. 17; BP p.l.c., 2009, p. 6, 8, 22, 24; Dubai Aluminum Company Ltd., 2009).

Minerals in the National Economy

In 2008, the gross domestic product (GDP) of the UAE grew at a rate of 7.4% at constant 2000 prices, which included an expansion of 12.1% in the hydrocarbon sector; 7.1% in the quarrying sector; 4.5% in the manufacturing sector (which includes the production of mineral-based commodities); and 6.7% in the construction sector. Overall, the non-oil GDP grew at a rate of 3.9% in 2008. The value of economic activity in the fuel minerals sector accounted for 36.8% of the GDP in 2008 compared with 33.5% in 2007. The value of economic activity in the nonfuel minerals sector accounted for 0.2% of the GDP, which was unchanged from the previous 5 years. The contribution of the manufacturing sector was 12.1% of the GDP compared with 12.7% of the GDP in 2007, and that of the construction sector was 7.4% of the GDP in 2008 compared with 7.2% in 2007 (Ministry of the Economy, 2009).

Production

The UAE's production of cement, chromite ore, and steel increased significantly in 2008, whereas the output of aluminum, crude oil, and natural gas was only slightly greater than in 2007 (table 1).

Structure of the Mineral Industry

The governments of the individual Emirates of the UAE maintained majority interest in the country's mineral industry. In the Emirate of Abu Dhabi, the Supreme Council of Petroleum was the highest government body that made policies and set goals for Abu Dhabi's hydrocarbon sector. Hydrocarbons were produced primarily in the Emirate of Abu Dhabi, mainly through the 14 subsidiaries of Abu Dhabi National Oil Co. (Adnoc). Exploration and production of oil and gas were carried out by Abu Dhabi Company for Onshore Oil Operations (Adco), Abu Dhabi Marine Operating Co. (Adma-Opco), and Zakum Development Co. (Zadco); companies that provided exploration and production services included Abu Dhabi Petroleum Ports Operating Co., Musafah Offshore Supply Base (Esnaad), and National Drilling Co.; oil and gas processing was conducted by Abu Dhabi Gas Industries Ltd. (Ggasco), Abu Dhabi Gas Liquefaction Ltd. (Adgas), and Abu Dhabi Oil Refining Co. (Takreer); chemical and petrochemical manufacturing companies included Ruwais Fertilizer Industries (Fertil) and Abu Dhabi Polymers Co. Ltd. (Borouge); and the distribution of refined petroleum products was the responsibility of ADNOC-Distribution (Abu Dhabi National Oil Co., 2009).

The government of the Emirate of Dubai owned the country's sole primary aluminum producer, Dubai Aluminum Company Ltd. (Dubal). Some of the cement companies were owned by individual Emirate governments, such as the governments of the Emirate of Ras Al Khaimah and the Emirate of Sharjah; other cement plants were owned by private and joint-venture companies. The federal Ministry of the Economy regulated the country's mineral resources and monitored the implementation of laws and agreement obligations of companies operating in the mineral sector (table 2).

Mineral Trade

The overall trade balance of the UAE continued to be on the positive side in 2008, and the country achieved a 35.5% increase in its trade surplus compared with that of 2007. The value of UAE exports of crude oil, condensate, and petroleum products increased in 2008 to $102.2 billion[2] (which was about 47.6% of total exports and reexports) from $73.8 billion in 2007 (which represented about 48.1% of 2007's total exports and reexports). Much of the increase in the value of hydrocarbon exports was owing to the increase in the price of crude oil, which, for the UAE, averaged $90.00 per barrel in 2008 compared with $70.70 per barrel in 2007. Natural gas exports were valued at $10.6 billion in 2008 compared with $7.8 billion in 2007. Refined petroleum products exports increased to $6.0 billion in 2008 from $5.4 billion in 2007 (Central Bank of the United Arab Emirates, 2009, p. 7).

[1]The United Arab Emirates is a federation of seven emirates: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah, and Umm Al Quwain.

[2]Where necessary, 2008 values have been converted form United Arab Emirates dirham (Dh) to U.S. dollars (US$) at the rate of Dh 3.6725= US$1.00.

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The value of U.S. imports of the UAE's aluminum products decreased by 24% to $241.5 million in 2008 from $317 million in 2007 and represented 18.8% of total U.S. imports from the UAE in 2008. U.S. crude oil imports were valued at $161.6 in 2008 (or 12.6% of total U.S. imports from the UAE), which was down from $267 million in 2007. U.S. imports of gem diamond increased by 35% to $142.5 million in 2008 and represented 11.1% of total U.S. imports from the UAE. Advanced iron and steel products imports were valued at $65.6 million, which represented an increase of 46.5% compared with imports in 2007 (Workman, 2009).

Steel imports by the UAE had been increasing steadily by about 1 million metric tons per year (Mt/yr) in the period between 2003 and 2007. In 2008, the UAE was the world's leading importer of steel concrete-reinforcing bar, which was valued at $6.77 billion. Sixty-seven percent of the UAE's steel imports came from Turkey and 12% came from China (Arab Steel, 2009).

The value of gold trade at the Dubai Multi Commodities Center (DMCC) continued to increase in 2008 to $29 billion, which was an increase of 53% compared with a value of $19 billion in 2007. The volume of gold exports in 2008 was 371 metric tons (t) compared with 287 t in 2007, which was an increase of 29%. The volume of gold imports in 2008 increased to 674 t from 559 t in 2007, which was an increase of 21%. India and Switzerland were the top exporters of gold to the UAE, and India and the United Kingdom were the top importers of gold from the UAE (Dubai Multi Commodities Center, 2009).

The value of trade for polished diamond at the DMCC was $5.29 billion during the first half of 2008, including $2.35 billion of diamond exports and $2.94 of diamond imports. Belgium, India, and Hong Kong were the UAE's top diamond-trading countries in terms of the value of trade. Although the value of diamond exports and imports were 99% and 153% more, respectively, than in the first half of 2007, diamond trade apparently declined considerably during the second half of 2008 because of the global economic downturn. No data were available from the DMCC on diamond trade statistics in the second half of 2008 (Dubai Multi Commodities Center, 2008).

Commodity Review

Metals

Aluminum.—Dubal was the world's seventh ranked producer of aluminum and had the largest single-site aluminum smelter operations in the Western World at Jebel Ali in the Dubai Emirate. In 2008, Dubal's production reached about 920,000 t of hot metal, which was 3.4% more than its output in 2007. In February 2008, Dubal started operating an eighth potline, which had a 2,782-kilogram-per-day capacity with 96% efficiency. The company, which employed 4,166 people, consumed 1.84 million metric tons (Mt) alumina and 300,000 metric tons per year (t/yr) of petroleum coke (Dubai Aluminum Company Ltd., 2009).

In January 2008, construction began at Emirates Aluminium Co. Ltd. (Emal)'s aluminum smelter complex in the industrial zone of Khalifah Port, which is located in Taweelah, Abu Dhabi. Emal was founded in 2007 as a 50-50 joint-venture between Dubal and Mubadala Development Co. PJSC (Mubadala). The first phase of the project was expected to be completed in April 2010 with a production capacity of 740,000 t/yr of primary aluminum at an estimated cost of $5.7 billion. The plant had 2 potlines, 756 reduction cells, and a dedicated 2,000-megawatt (MW)-capacity powerplant, which would use natural gas supplied by Adnoc through a gas-insulated substation to generate electricity. The plant would include an anode manufacturing unit and a multiple products casting house (Emirates Aluminum Co. Ltd., 2009).

To secure a long-term supply of alumina for its smelter, Dubal formed a joint-venture company, Guinea Alumina Corp. Ltd., in 2007 with BHP Billiton Ltd. of Australia (33.3% interest), Global Alumina Corp. of Canada (33.3% interest), and Mubadala (7.5% interest) to develop and operate the Sangaredi Refinery Project in the Republic of Guinea in West Africa. The initial alumina production capacity of the project was set at 3 Mt/yr, which would be produced from bauxite supplied by a 9-Mt/yr-capacity bauxite mine in the vicinity of the Sangaredi refinery. Dubal had 25% interest and was expected to receive 40% of the alumina produced in the first and second phases of the project. The $2.4 billion project had been scheduled to commence production in 2009, but production was delayed until 2010 because of increased construction material prices and the restructuring of project financing, which raised the project's cost to $3 billion (BHP Billiton Ltd., 2007; Husain, 2007).

Abu Dhabi Basic Industries Corp. (Adbic) signed a memorandum of understanding with Midal Cables Ltd. in July 2008 to form a $100 million joint-venture company that would build an aluminum cables plant in Taweelah, Abu Dhabi. The plant would receive its molten metal from the Emal smelter, which was being built at Taweelah, to produce 150,000 t/yr of aluminum rods (Abu Dhabi Basic Industries Corp., 2008).

Gulf Fluor L.L.C, which was a local private company, began building a new fluoride plant in the Abu Dhabi Industrial City 2 in 2007. The plant was expected to produce 60,000 t/yr of aluminum fluoride and 10,000 t/yr of hydrofluoric acid. The plant, which was expected to be completed in the third quarter of 2009 at a cost of $500 million, was to satisfy the increased demand for aluminum fluoride created by the Dubal smelter and the future demand of the Emal smelter (Arabian Business, 2007).

Copper.—Dubai Cable Co. Pvt Ltd. (Ducab), which was a subsidiary of the Abu Dhabi government's General Holding Corp. (GHC) and was jointly owned by the governments of Abu Dhabi and Dubai, was the only cable manufacturer in the UAE. In 2008, Ducab had three plants for copper production and wire cable manufacture—one at Jebel Ali in Dubai and two at the industrial city of Musaffah in Abu Dhabi. Ducab had an annual capacity to produce cables containing 110,000 t/yr of copper. In June 2008, Ducab inaugurated a copper rod plant, which was the first of its kind in the UAE. The $34 million plant was located near the Ducab Musaffah 1 plant. The copper plant converted raw copper cathode into 8-millimeter (mm)-diameter electrolytic tough pitch copper cables. Ducab formed a joint venture with Abu Dhabi Water and Electricity Authority (ADWEA) to build a 30,000-t/yr-capacity high-voltage cables plant. The plant was expected to commence production of high-voltage cables ranging from 66 kilovolts to 400 kilovolts by yearend

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2010. Ducab controlled almost one-half of the cable market in the UAE and benefited from the decrease in copper prices in the second half of 2008 and the increased demand for cables made of copper. The company planned to expand production to neighboring markets, including Qatar and Saudi Arabia (Metals Insider, 2008; Dubai Cable Co. Pvt Ltd., 2009; Husain, 2009).

Iron and Steel.—In 2008, Emirates Steel Industries (ESI), which was a subsidiary of Adbic and wholly owned by the Government of Abu Dhabi, was building two 1.6-Mt/yr-capacity direct-reduced iron (DRI) plants at the Industrial City of Abu Dhabi. The first plant was expected to be completed in 2009, and the second plant, in 2011 (Midrex Technologies Inc., 2009, p. 10). ESI moved forward with its plan to build the first integrated steel complex in the country that would use the latest models of electric arc furnace (EAF), DRI, and rolling mill technology to produce reinforcing bars and wire rod. The company's expansion plans were expected to raise its combined production capacity of billets, DRI, rebar, and wire rod products to 3 Mt/yr by 2011. By the end of 2009, ESI would have an output capacity of about 2 Mt/yr of rebar compared with 650,000 t in 2006. The company's production capacity was expected to reach 3 Mt/yr of steel products by 2012 and 6.5 Mt/yr by 2013 once the two phases of expansions are fully implemented (Arab Steel, 2009).

Al Nasser Industrial Enterprises LLC had three steel manufacturing subsidiaries in the UAE—Emirates Steel Establishment, Euro Gulf Steel Industries, and Gulf Steel Industries Co. Ltd. Gulf Steel built a rebar mill supplied by Siemens VAI in the Musaffah Industrial Zone in Abu Dhabi. The rebar line, which was designed to produce 400,000 t/yr of carbon steel bars, was scheduled to begin operating in early 2009. Emirates Steel Establishment, which began as a 20,000-t/yr-capacity ingots feeder unit for Gulf Steel, added a second unit with 40,000 t/yr of capacity and was in the process of adding a third unit that would include an EAF, a ladle furnace, and a concast that would have the capacity to produce 250,000 t/yr of steel billets (Al Nasser Industrial Enterprises LLC, 2009).

Hamriyah Steel FZC, which was a joint venture of Metalloinvest Steel, LLC of Russia and the UAE Government, continued building a rebar mill in the Sharjah Emirate. The equipment for the $156 million plant was supplied by SMS Meer S.p.A. of Italy, which was a subsidiary of SMS Meer GmbH of Germany. The steel mill was designed to produce 1 Mt/yr of rebar from billets supplied by Ural Steel of Russia, which was a subsidiary of Metalloinvest; it was scheduled to produce 700,000 t in 2010 and 1 Mt in 2011 (Steel Guru, 2009).

RAK Steel inaugurated rebar production in March 2008 from the new plant at Al Ghail, which is located in the Emirate of Ras Al Khaimah. RAK Steel was a joint venture of Middle East Traders Group and Ras Al Khaimah Investment Authority. The $50 million plant had a capacity of 50,000 t/yr and was the second ranked rebar producer in the UAE after the ESI rebar plant at Musaffah, Abu Dhabi (Steel Guru, 2008).

In June, Macsteel Gulf FZCO was established as a 50-50 joint venture of Alam Steel Industries LLC. (a Dubai-based company) and Macsteel S.A. of South Africa to build a plant that would process high-grade steel plates at the Jebel Ali Free Zone in Dubai Emirate. The Macsteel Gulf plant was expected to reach a production capacity of 100,000 t/yr of finished products within 5 years starting in 2009; Alam Steel had been operating a 500,000-t/yr-capacity rebar processing plant in Dubai Investment Park (Foreman, 2008; John, 2008).

In October 2008, Murray & Roberts Steel (Pty) Ltd. announced a plan to build a 300,000-t/yr-capacity rebar plant in Dubai Industrial City. The company had an existing 150,000-t/yr-capacity plant in the Emirate of Sharjah (O'Sullivan, 2008).

Qatar Steel Co. Q.S.C. of Qatar operated a rebar and coil processing plant at Jebel Ali in Dubai through its subsidiary Qatar Steel Co. FZE, which produced 102,000 t of coil in 2008. Qatar Steel sold 11% of its total rebar production to the UAE market and was in the process of upgrading the wire rod and bar mills in Dubai (Qatar Steel Co. Q.S.C., 2009, p. 13, 30).

Industrial Minerals

Cement.—In 2008, cement production in the UAE amounted to 13.2 Mt, which was 28% less than the local demand of about 18.2 Mt. Cement consumption was expected to increase by 25% to 23 Mt by 2010. The Union Cement Co. at Ras Al Khaimah, which was the cement market leader, produced 3.1 Mt of clinker and 3.0 Mt of cement; it was followed by Ras Al Khaimah Cement Co., which produced 1.0 Mt of clinker and 1.2 Mt of cement. The UAE imports of cement were about 5 Mt in 2008, which was 67% more than the 3.0 Mt imported in 2007; 194% more than the 1.7 Mt imported in 2006; and 733% more than the 0.6 Mt imported in 2005 (United Arab Emirates Cement, 2009).

Nitrogen.—Ruwais Fertilizer Industries Ltd., which was a joint venture of Adnoc (67% interest) and Total S.A. of France (33% interest) moved forward with its Fertil-1 debottlenecking expansion plan for the ammonia and urea complex in the Ruwais Industrial Zone, which was located 235 kilometers (km) from Abu Dhabi. The expansion would increase the plant's urea production capacity by 50% to 1 Mt/yr of urea; 70% of the output would be used by the Abu Dhabi Polymers Co.'s melamine plant that was being built in the vicinity, and the remaining 30% would be granulated and marketed as nitrogen fertilizer. The urea debottlenecking project was expected to be completed in July 2009.

A new $1.2 billion ammonia and urea production plant, Fertil-2, was planned to be built near the existing Fertil-1 plant. Fertil-2 would have a total production capacity of 1.3 Mt/yr of urea and 700,000 t/yr of ammonia. The combined capacity of the two plants when both projects are completed in January 2013 would be 1.9 Mt/yr of granulated urea and 1.2 Mt/yr of ammonia (Chemicals Technology, 2008; Ruwais Fertilizer Industries Ltd., 2008; Ashqar, 2009, p. 17).

Silica.—In 2008, Emirates Float Glass LLC, which was a subsidiary of Glass LLC and wholly owned by Dubai Investment PJSC, began production at its first float glass plant in Abu Dhabi and broke ground for its second float glass plant at the Industrial City 2 of Abu Dhabi. The second plant was expected to commence production in 2010. By 2010, the company would have two float glass plants in Abu Dhabi with a combined cost of $400 million and production capacity of 12,000 metric tons per day of architectural and automotive glass.

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In August 2008, Emirates Float Glass was granted a technology licensing agreement from PPG Industries of the United States for its second plant in Abu Dhabi (Al Bawaba Group, 2008).

Sulfur.—Production of sulfur as a byproduct of petroleum refining and natural gas processing had been on the rise in recent years. In 2008, Adnoc produced 1.8 Mt of sulfur whereas Abu Dhabi Gas Liquefaction Co. (Adgas) produced 375,000 t of liquid sulfur. UAE sulfur production was expected to increase sharply to about 7 Mt/yr when the natural gas projects planned by Adnoc are completed between 2009 and 2012 (Ashqar, 2009, p. 30, 41).

Mineral Fuels and Other Sources of Energy

Coal.—In July 2008, the Government of the Emirate of Ajman signed an agreement with MMC Corp. Bhd of Malaysia to establish the first coal-fired powerplant in the Gulf region. The $2 billion plant was expected to have the capacity to generate 1 gigawatthour of electricity and to commence production in 2012. In December 2008, Ras Al-Khaimah Investment Authority was preparing to invite bids for a coal-fired powerplant to be built at Mina Saqr, which is located 110 km northeast of Dubai. The initial capacity of the plant would be 500 to 600 MW; this amount could increase to 4,000 MW in the final phase of the project (Carlisle, 2008; Maree, 2008).

Natural Gas.—According to the U.S. Energy Information Administration, the UAE was a net natural gas importer in 2008. UAE imported natural gas from Qatar through the Dolphin pipeline to satisfy the country's increased demand for gas. The natural gas deficit started in 2007 because of the increased demand for gas by powerplants, water desalinization plants, petrochemical plants, and an enhanced oil recovery process, which included injecting mature oilfields with natural gas (U.S. Energy Information Administration, 2009).

In August 2008, Adnoc signed an interim agreement with ConocoPhillips Co. of the United States to develop the Shah sour gasfield, which is located 180 km southwest of the city of Abu Dhabi. Under the interim agreement, which would give Adnoc 60% interest and ConocoPhillips 40% interest in the project, the two companies would share the cost of the project's front-end engineering design. The development of the Shah project would include the building of a 10-billion-cubic-meter-per-year-capacity natural gas processing plant. The gas produced at Shah would be desulfurized and transported through 275 km of pipelines from Shah to Habshan and Ruwais. The sulfur would either be transported in a liquid form by pipelines similar to natural gas or granulated at Shah before being transported by rail to Ruwais (ConocoPhillips Co., 2008).

In October 2008, Dolphin Energy Ltd., which was owned by Mubadala (51%), Occidental Petroleum Corp. of the United States, and Total S.A. of France (24.5% each), delivered its first gas to Oman as part of a 25-year gas sales agreement between Dolphin and Oman Oil Co. signed in 2005. Earlier in the year (in April), Dolphin had delivered its first gas to the Emirate of Sharjah. Dolphin received the gas produced from the offshore gasfields of Qatar; treated and compressed it at Ras Laffan, Qatar, and then transported it undersea to the Taweelah receiving facilities in Abu Dhabi through the company's export pipeline. Dolphin moved forward with the construction of the Taweelah to Fujairah Gas Pipeline (TFP). The TFP project included building a 1.20-meter-diameter pipeline that extends 240 km across the United Arab Emirate's desert and mountain areas. The project was being built with PJSC Stroytransgaz of Russia and was expected to be completed in the third quarter of 2010 (Dolphin Energy Ltd., 2009).

Nuclear Energy.—In 2008, the Government issued a white paper entitled "Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy." The paper outlined the UAE's comprehensive policy on the development of nuclear energy for peaceful domestic power generation in partnership with the International Atomic Energy Agency and its commitment to the highest levels of nonproliferation, safety, security, and sustainability. The Government was preparing for the creation of the Emirates Nuclear Energy Corp. as an entity that would manage the country's future nuclear program (Emirates Nuclear Energy Corp., 2008).

Petroleum.—The full field development of the UAE's largest oilfield, the Upper Zakum oilfield, was one of the Government's main priorities. Adnoc, Exxon Mobil Corp. of the United States, and Japan Oil Development Co. were partners in the Upper Zakum oilfield development project to increase its production capacity to 750,000 barrels per day (bbl/d) from 550,000 bbl/d by the year 2015 and ultimately to 1.2 million barrels per day. The development of the Umm Shaif offshore oil and gas project started in 2007 and continued through 2008. The aim of the project was to increase oil production to 300,000 bbl/d by 2010 (U.S. Energy Information Administration, 2009).

In December 2008, China National Petroleum Corp. (CNPC) and International Petroleum Investment Co. (IPIC) signed an engineering, procurement, and construction contract for the Abu Dhabi Crude Oil Pipeline (ADCOP). ADCOP was a 400-km-pipeline that would carry oil from the Habshan oilfield to the Port of Fujairah on the Gulf of Oman. The $3.29 billion project would be jointly executed by China Petroleum Engineering & Construction Corp. (CPECC) and China Petroleum Pipeline Bureau (CPPB). It was the largest overseas turnkey engineering construction project for which the CNPC had ever contracted. The project was expected to be completed by August 2011. ADCOP would enable the UAE to export up to 60% of its oil production from the Gulf of Oman, thus bypassing the checkpoints at the Strait of Hormuz and the potential navigation risk in the Gulf of Oman waters (Pipeline & Gas Journal, 2009; U.S. Energy Information Administration, 2009).

Carbon Capturing.—In November 2008, Masdar signed a contract with Mustang Engineering (a subsidiary of John Wood Group p.l.c. of the United States) to provide front-end and engineering design services for the Abu Dhabi Carbon Capture and Storage project. The project included arresting carbon dioxide (CO_2) emissions from industrial and energy plants in Abu Dhabi, transporting the captured CO_2 through pipelines, and reinjecting it in Abu Dhabi's oilfields to boost oil recovery. The first stage of the project comprised reinjection of 5 Mt of CO_2 from three sources of emission by yearend 2013 (Abu Dhabi Future Energy Co., 2008b).

Solar Energy.—In January 2008, Abu Dhabi Future Energy Co. (Masdar), which was wholly owned by Mubadala, devoted

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$15 billion for investment in alternative energy projects. The projects would include commercialization, development, exploration, and manufacturing of hydrogen, solar, and wind energy sources as well as carbon reduction and recycling technology. Masdar began construction of concentrating solar powerplants (CSPs) in Abu Dhabi; the first of such plants, Shams1, was expected begin generating power from solar energy by yearend 2010. In March 2008, Masdar and Sener Grupo de Ingeniería S.A. of Spain formed a joint venture named Torresol Energy to design, build, and manage CSPs in the "sunbelt" regions of the world.

In May 2008, Masdar announced a $2 billion investment in a three-step thin-film photovoltaic solar technology project. The first step of the project consisted of constructing two photovoltaic production plants. The first plant, which broke ground in August in Erfurt, Germany, at a cost of $230 million, was expected to start production of solar energy in the third quarter of 2009. The plant would serve as a pilot project and a demonstration of technology transfer to the bigger plant to be built in Abu Dhabi, which was expected to begin initial production in the second quarter of 2010. The combined production capacity of the two plants would be 210 MW (Abu Dhabi Future Energy Co., 2008a, c).

Outlook

The economic prosperity and diversity of the UAE is expected to continue in the next 5 years but perhaps at a more modest rate than the robust rate of growth of the previous 5 years. The mineral industry of the UAE is expected to continue to grow to satisfy the increased demand for minerals required for economic growth. The government of Abu Dhabi Emirate is planning massive investment in infrastructure and the manufacturing sector, including developing natural gasfields and oilfields; carbon capturing; producing hydrogen energy; and developing nuclear, solar, and wind energy projects to satisfy the increasing demand for energy. Production of aluminum, cement, float glass, natural gas, nitrogen fertilizer, steel, and sulfur is expected to increase significantly when the current expansion projects are completed.

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TABLE 1
UNITED ARAB EMIRATES: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity[3]		2004	2005	2006	2007	2008
METALS						
Aluminum, primary		683 [4]	722 [4]	861 [4]	890 [4]	920 [4]
Chromite ore		7 [r, 4]	(5)	(5)	19 [4]	34 [4]
Steel, crude		90	90	90	90	100
INDUSTRIAL MINERALS						
Cement, hydraulic		9,000	10,000	11,000 [r]	12,000 [r]	13,200 [4]
Gypsum		110	120	130	150	160
Lime		50	50	60	60	60
Nitrogen:						
N content of ammonia		380	360	380	380	380
N content of urea		270	260	270	270	270
Sulfur[6]		1,930	1,950	1,950	1,950	2,175 [4]
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	68,030 [r, 4]	70,470 [r, 4]	76,194 [r, 4]	78,963 [r, 4]	80,550 [4]
Dry	do.	46,290 [r, 4]	47,790 [r, 4]	48,790 [r, 4]	50,290 [r, 4]	50,240 [4]
Natural gas plant liquids	thousand 42-gallon barrels	146,000	114,000	114,000	114,000	114,000
Petroleum:						
Crude	do.	855,000	868,000	937,000	933,000	951,660 [4]
Refinery products:						
Liquefied petroleum gas	do.	1,500 [r]	1,600	1,600 [r]	2,000	3,600
Gasoline	do.	15,000 [r]	16,000 [r]	22,000 [r]	20,000 [r]	18,000
Kerosene	do.	43,000 [r]	43,000 [r]	43,000 [r]	39,000 [r]	39,000
Distillate fuels	do.	35,000 [r]	32,000 [r]	33,000 [r]	32,000 [r]	31,000
Residual fuels	do.	9,000 [r]	9,000 [r]	8,000 [r]	7,000 [r]	6,000
Other	do.	59,000 [r]	62,000 [r]	49,000 [r]	45,000 [r]	50,000
Total	do.	163,000 [r]	164,000 [r]	157,000 [r]	145,000 [r]	148,000

[r]Revised. do. Ditto.
[1]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
[2]Table includes data available through January 31, 2010.
[3]In addition to the commodities listed, crude industrial minerals, such as common clays, diabase, gravel, limestone, marble, sand, and shale presumably are produced, but output is not reported, and information is inadequate to make reliable estimates of output.
[4]Reported figure.
[5]Negligible or no production.
[6]Byproduct of petroleum refining and natural gas processing.

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TABLE 2
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Dubai Aluminum Company Ltd. (Dubal) (Investment Corporation of Dubai, 100%)	Jebel Ali, Dubai	950
Cement:				
Portland		Gulf Cement Company (National Investments Company of Kuwait, 27%, and Government of Ras Al Khaimah, 8%)	Khor Khuwair, Ras Al Khaimah	2,700
Do.		Sharjah Cement and Industrial Development Co. (private, 70%, and Government of Sharjah, 30%)	Sharjah	3,000
Do.		National Cement Company P.S.C.	Dubai	1,500
Do.		National Cement Factory	Abu Dhabi	2,500
Do.		Union Cement Co. (Government of Ras Al Khaimah, 41%, and Abu Dhabi Investment Authority, 20%)	Khor Khuwair, Ras Al Khaimah	4,200
Do.		Fujairah Cement Industries	Dibba, Fujairah	3,100
Do.		Emirates Cement Factory (General Holding Corp.)	Al-Ain, Abu Dhabi	2,200
Do.		Ras Al Khaimah Cement Co.	Khor Khuwair, Ras Al Khaimah	1,200
Do.		Arabian Gulf Cement Company LLC	Ajman	900
Do.		Jebel Ali Cement Co. (Sharaf Industries, 100%)	Jebel Ali, Dubai	800
Do.		Umm al-Qaywayn Cement Industries Co.	Umm al-Quwain	1,600
White		Ras Al Khaimah Company for White Cement and Construction Materials	Ras Al Khaimah	500
Gold, refined	metric tons	Emirates Gold (private, 100%)	Dubai	200
Do.	do.	Al Ghurair Giga Gold (private, 100%)	do.	100
Do.	do.	ARY Aurum Plus (private, 100%)	Sharjah	25
Do.	do.	Al Ghaith Gold (private, 100%)	Dubai	100
Iron and steel:				
Direct-reduced		Emirates Steel Industries (ESI)	Abu Dhabi	1,600 [p]
Do.		Al Nasser Industrial Enterprises LLC	do.	250 [p]
Steel:				
Billet		Emirates Steel Industries (ESI)	do.	1,500 [p]
Do.		Al Nasser Industrial Enterprises LLC	do.	220 [p]
Wire rod		Emirates Steel Industries (ESI)	do.	480 [p]
Rebar		do.	do.	620 [p]
Do.		Alam Steel	Dubai	500
Do.		Al Nasser Industrial Enterprises LLC	Abu Dhabi	90 [p]
Do.		Essar Steel-India	Hamriyah Free Zone, Sharjah	1,000 [p]
Do.		Metalloinvest-Russia	do.	1,000 [p]
Do.		Union Iron & Steel Company LLC	Abu Dhabi	500 [p]
Do.		Conares Metal Supply Ltd.	Dubai	400 [p]
Do.		Star Steel International LLC	Jebel Ali, Dubai; Hamriyah Free Zone, Sharjah	360 [p]
Natural gas, liquefied		Abu Dhabi Gas Liquefaction Company Ltd.	Das Island	5,149
Petroleum:				
Crude	thousand 42-gallon barrels per day	Abu Dhabi Company for Onshore Oil Operations (Adco) [Abu Dhabi National Oil Co. (Adnoc), 60%; BP p.l.c., 9.5%; Exxon Mobil Corp., 9.5%; Royal Dutch Shell Group, 9.5%; Total S.A., 9.5%; Participations and Explorations Corp., 2%]	Onshore Abu Dhabi oilfields, including the Asab, the Bab, the Bu Hasa, the Jarn Yaphour, the Sahil, the Shah, Abu Al Bukhoosh, and the Arzanah fields	1,300
Do.	do.	Abu Dhabi Marine Operating Co. (Adma-Opco) [Abu Dhabi National Oil Co. (Adnoc), 60%; BP p.l.c., 14.67%; Total S.A., 13.33%; Japan Oil Development Corp., 12%]	Offshore Abu Dhabi oilfields, including the Umm Sharif and the Zakum fields	600
Do.	do.	Zakum Development Co. (Zadco) [Abu Dhabi National Oil Co. (Adnoc), 63.36%; ExxonMobil Abu Dhabi Offshore Petroleum Company Ltd., 24.64%; Japan Oil Development Corp., 12%]	Offshore Abu Dhabi oilfields, including the Satah, the Umm Al-Dalkh, and the Upper Zakum fields	518

See footnotes at end of table.

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TABLE 2—Continued
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum—Continued:				
Crude—Continued	thousand 42-gallon barrels per day	Dubai Petroleum Co. (100%)	Dubai oilfields, including the Margham, the Falah, the Fateh, the Rashid, and S.W. Fateh fields	100
Do.	do.	Ras Al Khaimah Gas Commission	Ras Al Khaimah oilfields, including the Saleh field	1
Do.	do.	BP p.l.c. and Crescent Petroleum Company Inc.	Sharjah oilfields, including the Kahaif, the Saja, the Moveyid, and the Mubarek fields	50
Refined products	do.	Abu Dhabi Oil Refining Co. (Takreer) [Abu Dhabi National Oil Co., (Adnoc), 100%]	Ruwais refinery, Ruwais, Abu Dhabi	350
Do.	do.	Emirates National Oil Company Ltd. (Investment Corporation of Dubai, 100%)	Jebel Ali refinery, Jebel Ali, Dubai	120
Do.	do.	Abu Dhabi Oil Refining Co. (Takreer) [Abu Dhabi National Oil Co. (Adnoc), 100%]	Abu Dhabi refinery, Umm Al Nar, Abu Dhabi	150
Do.	do.	Sharjah Oil Refining Co. F.Z.C. (FAL Group, 100%)	Sharjah refinery, Hamriyah Free Trade Zone	71
Do.	do.	Inactive refinery, formerly operated by Metro Oil Corp.	Fujairah	90
Silica, glass	metric tons	Guardian Zoujaj International Float Glass Co. LLC (Guardian RAK)	Ras Al Khaimah	255,500
Do.	do.	Emirates Float Glass LLC (Dubai Investment PJSC, 100%)	Industrial City 1 and 2, Abu Dhabi	440,000
Silver, refined	do.	Emirates Gold (private, 100%)	Dubai	100

[P]Preliminary. Do., do. Ditto.

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The Mineral Industry of Yemen

By Mowafa Taib

Yemen has substantial reserves of metallic and nonmetallic minerals, which could be mined to increase the mineral industry's contribution to the national economy. Except for hydrocarbon production, which had been an important source of revenue for the Government in recent years, Yemen was not a significant contributor to the world's mineral supply. In 2008, Yemen suffered natural disasters, including floods in the Hadramawt and the Al Mahrah Governorates, as well as political turmoil, including the ongoing conflict between the Government and Al-Houthi rebels, which continued to have an adverse effect on mining activity in the conflict area in and around the Sa'dah Governorate in northwestern Yemen.

Minerals in the National Economy

In 2008, crude oil exports were valued at $7.77 billion, or 11.0% of the gross domestic product (GDP), compared with $6.26 billion, or 11.8% of the GDP, in 2007. The oil sector accounted for 90% of total merchandise exports and about 73% of Government revenue. The International Monetary Fund projected that Yemen's hydrocarbon exports in 2009 would be reduced in value by 30%, or by 6.1% of the GDP. The Government had been concentrating on the production and exporting of liquefied natural gas (LNG) to compensate for the expected revenue losses from the projected decline in crude oil production. Net direct investments in the LNG sector, which were $1.20 billion in 2006, increased to $1.79 billion in 2007, then decreased to $875 million in 2008. Yemen exported 44.5 million barrels (Mbbl) of crude oil in 2008 compared with 42.4 Mbbl in 2007 and 63.7 Mbbl in 2006. Yemeni crude oil exports and refinery products were received by China (39.0%), Thailand (30.0%), South Africa (14.8%), India (9.1%), Malaysia (4.5%), and Singapore (2.6%). Domestic sales of Yemeni crude oil included 24.4 Mbbl to the Aden refinery and 3.1 Mbbl to the Marib refinery (Middle East Economic Digest, 2008, p. 38; International Monetary Fund, 2009, p. 25).

Government Policies and Programs

Article 8 of the Constitution gives the state ownership of the country's mineral and energy resources. Metallic and industrial mineral exploration and production operations were governed by the Mines and Quarries law No. 24 of 2002. Mineral projects also were subject to the provisions of the Investment law No. 22 of 2002. A new mining law and regulations were prepared by the Yemen Geological Survey and Mineral Resources Board (GSMRB) under the Yemen Mining Policy Reform Project with the help of the International Finance Corp. (IFC) of the World Bank Group and Yemen's Ministry of Oil and Minerals. The new law, which emphasizes transparency, efficiency, and accountability, was expected to be presented to the Parliament for approval in 2009. The proposed law would apply an 8% royalty for precious stones, a 5% royalty for nonmetallic minerals, and a 3% royalty for metallic and other minerals. The law also proposes a 30% to 35% income tax on remitted dividends and an exemption of import duties during mine construction (Yemen Geological Survey and Mineral Resources Board, 2009a).

Production

In 2008, cement production increased by about 22%, which was attributable to the startup of a new production line at the state-owned Amran plant, which was operated by Yemen Cement Corp., and to the partial year production of National Cement Co.'s plant at Wadi Saim, which was the first privately owned plant in Yemen. In 2008, crude oil production decreased by 8% compared with a 13% decrease in 2007, thus extending the downward trend in production following the peak of 160 Mbbl achieved in 2001. The decrease in crude oil output in 2008 (33% less than that of 2001) was attributable to the depletion of oil reserves. Yemen also produced gypsum, limestone, natural gas, and salt for domestic use and export (table 1).

Structure of the Mineral Industry

The GSMRB is one of the agencies of the Ministry of Oil and Minerals. The agency is responsible for promoting investment in Yemen's mining sector and disseminating information on the mineral resources of Yemen, including copper, gold, lead, nickel, platinum-group metals (PGM), and zinc. The GSMRB identified seven occurrences of gold mineralization in Yemen that were minable. The Precambrian basement of Hadramawt Governate had four such locations (the Al-Hariqah, the Hiro, the Musayani, and the Wadi Madan); two other locations [the Al-Wazeyaah (Ta'iz,) and the Waraqah (Dhamar)] had Tertiary volcanic-hosted gold mineralization, and one location [the Am Surrah-Habalain (Abyan)] had sediment-hosted gold mineralization. Several occurrences of copper, nickel and PGM mineralization were identified, including the Al-Humurah, the Al-Qabyta, the Qaifa, the Salibah, the Suwar, and the Wadi Marbar (Yemen Geological Survey and Mineral Resources Board, 2009b, c).

As of November 2008, 16 mining companies were registered with the GSMRB to search for, explore, or exploit base-metals, precious metals, and industrial mineral resources in Yemen. These companies were Ansan Wakfs (Hadramaut) Ltd. of the United Kingdom and Yemen, which had a license to search for rare-earth minerals; Arab Mining Co. of Jordan, which held a prospective permit to search for dolomite and magnesite; Arabian Limestone and Dolomite Co. S.A. of India and the United Kingdom, which was licensed to explore for dolomite and limestone; Cantex Mine Development Corp. of Canada, which was exploring for copper, gold, nickel, and platinum; CC Mining Co. S.A. of Panama; Jabal Salab Co. (Yemen) Ltd. of the Cayman Islands and Yemen, which was mining

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a zinc oxide deposit; Meshreq Iron Ore Mining and Trading Co. of India, which had an exploration permit for titanium; Nagarjuna Corp. Ltd. of India, which was registered to explore for gold; Naine Mineral Resources of Singapore; Minerals and Metal Resources Shabbir Co. Ltd. of India, which held an iron ore exploitation contract and iron ore exploration license; Thani Dubai Mining of the United Arab Emirates, which was exploring for gold; Triton Resources Pty Ltd. of Australia, which held an exploration license for metallic minerals; Stone Resources (Yemen) Ltd. of China, which held a search permit for cobalt, copper, and nickel; Volrock Mining Ltd. of Saudi Arabia and the United Kingdom, which had a permit to explore for gold; Yemen Iron Steel Ltd., which was exploring for iron ore; and 3S Mineral Ltd. of India and the United Kingdom, which was quarrying chalk limestone (Yemen Geological Survey and Mineral Resources Board, 2008).

Natural gas and petroleum exploration and production activities were managed by the Petroleum Exploration and Production Authority of the Ministry of Oil and Minerals. About 34% of the crude oil produced in Yemen in 2008 was refined by state-owned Aden Refinery Co. and 4% was refined by Yemen Oil Refining Co. (Yemen Oil Refining Co., 2008).

Commodity Review

Metals

Cobalt, Copper, and Nickel.—Cantex began drill tests of the Suwar nickel-copper-cobalt deposit following the completion of an 11-hole drilling program at the Wadi Qutabah project. Cantex, which wholly owned the exploration license, planned to complete a prefeasibility study of the Suwar project by mid-2012. In November 2008, Companhia Vale Do Rio Doce (CVRD) of Brazil committed a $2 million option to the project, drilled near the mineralization area discovered by Cantex, collected and analyzed soil samples, and performed geophysical surveys. Cantex and CVRD were trying to discover a continuous mineralization that would make the prefeasibility study worth additional investment (Cantex Mine Development Corp., 2009).

Zinc.—The GSMRB mapped 16 zinc-lead-silver occurrences that were concentrated in the rift valley that extends from the Gulf of Eden coast on the Arabian Sea to Jabal Al-Ahmar, which is located northwest of Sana'a. However, the Jabal Salab and the Tabaq deposits were considered to be the main areas of zinc-lead mineralization (Yemen Geological Survey and Mineral Resources Board, 2009d).

Jabal Salab Co., which was registered in the Cayman Islands and owned jointly by ZincOx Resources p.l.c. of the United Kingdom (52% interest) and Ansan Wikfs Investments Ltd. of Yemen (48%), continued with construction of the Jabali zinc-lead-silver mine, which was the first large-scale metal mine in Yemen. The Jabali Mine is located in the Nehim area about 110 kilometers (km) northeast of Sana'a. Production was expected to begin in the first quarter of 2010. The mine would treat 800,000 metric tons per year (t/yr) of zinc ore for more than 12 years using an open pit with a 2:1 strip ratio. The deposit was estimated to contain 12.6 million metric tons (Mt) of oxide ore grading 1.2% lead, 68 grams per metric ton silver, and 8.9% zinc, and minable reserves were estimated to be 8.7 Mt grading 9.2% zinc with a cutoff grade of 4.4%. The ore would be crushed, calcined, and milled to produce 70,000 t/yr of zinc oxide (Yemen Geological Survey and Mineral Resources Board, 2009d; ZincOx Resources plc, 2009, p. 10).

Industrial Minerals

Cement.—The Government proposed building five new cement plants to increase the national cement production capacity to 7 million metric tons per year (Mt/yr) by 2009 to reduce the country's reliance on imported cement. Yemen imported 1.942 Mt in 2007 from such countries as Oman and Pakistan. According to the latest available Government statistics, Yemen produced 1.73 Mt and consumed 3.67 Mt of cement in 2007. The production capacity in 2008 was estimated to be 3 Mt.

In June 2008, the IFC, which is the private sector development organization of the World Bank Group, approved a loan of $70 million of its own funds and arranged for another $55 million in loans from commercial banks for the construction and operation of a greenfield integrated cement plant for Arabian Yemen Cement Co. Ltd. at Al-Oyoun, which is located 60 km north of the Port of Mukalla (the capital of Hadramawt Governorate). The cost of the plant, which covers 22 square kilometers, was estimated to be $260 million. The plant would have 1.5-Mt/yr production capacity of portland, salt, and sulfate-resistant cement. Sinoma International Engineering Co. Ltd. of China signed a turnkey contract to build the factory under the supervision of Hotec Consulting Private Ltd. of India. The plant was owned by the Eastern Province Cement Co. of Saudi Arabia and other Yemeni investors. Initial production from the plant was expected to commence in 2009 (International Finance Corp., 2008; Zawya Ltd., 2009a, b).

In July 2008, National Cement Co. began production at its greenfield cement plant in Wadi Saim, which is located 70 km northeast of the city of Aden. The 1.5-Mt/yr-capacity plant, which was powered by coal, was the first privately owned cement plant to commence production in Yemen. The plant was owned by Hayel Saeed Anam Group and another 4,000 shareholders (National Cement Co., 2008).

Mineral Fuels

Natural Gas.—Yemen's proved gas reserves at the end of December 2008 were estimated to be 556 billion cubic meters (18.215 trillion cubic feet). Eighty-one percent of the gas reserves was in the Marib-Block 18 and 7% was in the Jennah-5 gasfield (Ministry of Oil and Minerals, 2009, p. 76).

The construction of a two-train 6.7-Mt/yr-capacity natural gas liquefaction plant and related dock facilities at the Belhaf terminal on the Gulf of Aden for Yemen LNG Co. continued in 2008. The project, which began in 2005, included establishing a 320-km natural gas pipeline to carry the dry gas produced from Block 18 fields in the Marib-Jawf region of central Yemen to the natural gas liquefaction plant at Belhaf in the south. The $4.5 billion that was invested in the Yemen LNG project was considered the single largest investment ever made in the

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country. The first shipment of LNG was expected by yearend 2009 using four LNG carriers that were being built in Japan with a total capacity of 644,000 cubic meters. The shareholders of Yemen LNG Co. were as follows: Total S.A. of France, 39.62%; Hunt Oil Co. of the United States, 17.25%; Yemen Gas Co., 16.73%; SK Energy Co. Ltd., 9.55%; Korea Gas Corp., 6.00%; Hyundai Corp. of the Republic of Korea, 5.88%; and the General Authority for Social Security and Pensions of Yemen, 5.00% (Ministry of Oil and Minerals, 2009, p. 76; Yemen LNG Co., 2009).

Petroleum.—In November 2008, the Government of Yemen, Korea National Oil Corp., and Total formed a joint venture to explore for gas and oil in the onshore Block 70 located southeast of the Marib Basin. The block was held by Daesung Industrial Co. Ltd. and Samsung C&T Corp. (both of the Republic of Korea), Total, and Yemen General Corporation for Oil and Gas. In 2008, Yemen produced 294,000 barrels per day out of its proven crude oil reserves, which were estimated to be 3 billion barrels. Yemen exported 44.5 Mbbl of crude oil, about 46% of which was from Al Masila field. Two oil discoveries were reported in the Sharnah-1 well of Block 47 and in the basement near the Henin-1 well of Block 71 (Petroleum Economist, 2008; Public Exploration and Production Authority, 2008; Organization of Arab Petroleum Exporting Countries, 2009, p. 9, 19).

Outlook

The Government, with the help of the IFC, continued to promote investment in Yemen's mineral resources, especially the development of its known mineral deposits, which included clays, feldspar, gold, iron ore, lead, limestone, perlite, PGM, quartz, salt, silica sand, silver, and zeolite. Yemen's crude oil resources are depleting quickly and the deficit in Government revenue because of declining oil production has pressed the Government to invest in the development of large natural gas reserves and to begin exporting LNG in late 2009. Zinc (and possibly lead and silver) production from the Jabal Salab Mine is expected to start in 2010. The volume of cement production will increase with the commencement of the new cement plants that are being built. Political unrest, especially the conflict between the Government and the Al-Houthi opposition groups, which continued throughout 2008 north of Sana'a, is likely to continue to have an adverse affect on the development of mineral production in northwestern Yemen.

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TABLE 1
YEMEN: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2004	2005	2006	2007	2008
Cement		1,546	1,550	1,470	1,728	2,111
Gypsum		37	38	44	44	50
Natural gas:[e]						
Gross	million cubic meters	28,500	29,500	28,100	29,200 r	29,600
Dry	do.	731 r	758 r	788 r	820 r	842
Liquids	thousand 42-gallon barrels	3,650 r	3,650 r	3,650 r	3,650 r	3,650
Petroleum:						
Crude	do.	147,500	146,100 r	133,500 r	116,700 r	107,400
Refinery products:						
Liquefied petroleum gas	do.	475 [3]	438 [3]	438 r, [3]	438	438
Naphtha	do.	1,100	1,200	1,200 [3]	1,400	1,400
Gasoline	do.	7,665 r, [3]	5,110 r, [3]	5,110 r	5,110 r	5,110
Kerosene	do.	6,972 r, [3]	4,052 r, [3]	4,052 r	4,052 r	4,052
Distillate fuel oil	do.	10,330 r, [3]	7,775 r, [3]	7,775 r	7,775 r	7,775
Residual fuel oil	do.	18,400 r, [3]	14,750 r, [3]	14,750 r	14,750 r	14,750
Other	do.	5,161 r, [3]	3,723 r, [3]	3,723 r	3,723 r	3,723
Total	do.	50,103 [3]	37,048 [3]	37,048 r	37,248 r	37,248
Salt[e]		88	90	100	100	100
Sand and gravel[e]		668	1,030	1,162	1,200	1,200
Stone:						
Marble	thousand square meters	97	100	127	130	130
Other quarried stone		2,269	3,533	3,986	4,000	4,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. do. Ditto.

[1]Table includes data available through November 30, 2009.

[2]In addition to the commodities listed, aggregate, feldspar, limestone, mica, pumice, rolled-steel bars, scoria, silica sand, talc, and zeolites may have been produced but available information is inadequate to make a reliable estimate of output.

[3]Reported figure.

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TABLE 2
YEMEN: STRUCTURE OF THE MINERAL INDUSTRY IN 2008

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Amran Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Amran	1,500,000
Do.		Al Barh Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Mafraq near Taiz	580,000
Do.		Bajil Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Bajil	262,000
Do.		Yemen Cement Co.	Wadi Saim, Aden	1,500,000
Natural gas	million cubic meters	Safer Exploration and Production Operations Co. (Government, 100%)	Block 18	20,000 [1]
Do.	do.	Yemen Exploration and Production Co. (Yemen Hunt Oil Co., 51%, and Exxon Yemen, Inc., 49%)	Block 14	10,000 [1]
Petroleum:				
Crude	million 42-gallon barrels	Crude oil was produced under production-sharing agreements, with joint ventures that included domestic or international companies, and one Government-owned operation	Oilfield on Blocks 4, 5, 9, 10, 14, 18, 32, 43, 51, 53, S-1, and S-2	160
Refined	42-gallon barrels per day	Aden Refinery Co. (Government, 100%)	Refinery at Aden	120,000
Do.	do.	Yemen Oil Refining Co. (Yemen Hunt Oil Co. and Exxon Yemen, Inc., 75.5%, and Yukong Group, 24.5%)	Topping plant at Marib	20,000
Salt:				
Crude:				
Marine		Local private companies	Eleven saltworks near Aden	150,000
Rock		do.	Five salt mines near Salif	140,000
Refined		Salt Refining and Packing Factory (Government)	Salif	NA
Do.		Aden Salt Factory (Government)	Aden	NA
Steel, rolling mills		Arab Iron and Steel Corp.	do.	40,000
Do.		Mukalla Iron and Steel Co.	Rayan	120,000 [2]
Do.		Yemen Steel Manufacturing Company Ltd. (Al-Rhabi Trading Group, 100%)	Al Hodeidah	120,000
Stone, block, crushed, or dimension		About 1,900 local private companies	Dhamar, Mayana, Sana'a, Taiz, and Wadi Marek areas	NA

Do., do. Ditto. NA Not available.

[1]Most produced natural gas was stripped of hydrocarbon liquids and reinjected into oil reservoirs.

[2]Under construction.

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